

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON

DATANET LLC,

Plaintiff,

NO. 2:22-cv-01545

V.

MICROSOFT CORPORATION,

COMPLAINT FOR PATENT INFRINGEMENT

JURY DEMAND

Plaintiff Datanet LLC (“Datanet” or “Plaintiff”), by and through its attorneys, for its Complaint against defendant Microsoft Corporation (“Defendant”) alleges as follows:

NATURE OF THE ACTION

1. This is a civil action for patent infringement under the patent laws of the United States, 35 U.S.C. § 1 et seq.

2. This action arises from Defendant's unlicensed use of Datanet's patented technology in Defendant's file hosting/backup service called Microsoft OneDrive ("OneDrive"). The marketing, testing, importation, use and sale of such product(s) within the United States infringes upon the intellectual property rights of Datanet. This illegal practice will continue unless, and until, the Court puts an end to it.

3. By this action Plaintiff seeks money damages, exemplary damages and attorneys' fees arising from Defendant's patent infringement under the Patent Act, 35 U.S.C. §§ 271, 283–285.

1 **PARTIES**

2 4. Plaintiff is a limited liability company formed under the laws of Nevada with a
3 principal place of business located in Colorado.

4 5. Defendant is a corporation organized under the laws of Washington.

5 6. Defendant maintains its headquarters at 1 Microsoft Way, Redmond, Washington.

6 **JURISDICTION AND VENUE**

7 7. This is an action for infringement against Defendants brought under the Patent
8 Act, 35 U.S.C. § 271 based upon Defendants' unauthorized commercial manufacture, testing,
9 use, importation, offer for sale and sale of its file hosting/backup service called OneDrive which
10 infringes upon United States ("U.S.") Patent Numbers 8,473,478 ("'478 Patent), and 9,218,348
11 ("'348 Patent"), and 10,585,850 ("'850 Patent).

12 8. This Court has subject matter jurisdiction over the matters asserted herein under
13 28 U.S.C. §§ 1331 and 1338(a).

14 9. This court has personal jurisdiction over Defendant because Defendant is a
15 Washington Corporation that maintains its headquarters in Redmond, Washington, has a
16 significant presence in Washington, conducts its business throughout the United States, including
17 within the state of Washington, and has committed in this District the acts of patent
18 infringement, which have given rise to this action.

19 10. Venue is proper in this District under 28 U.S.C. §§ 1391 and 1400(b) as
20 Defendant is a Washington Corporation that maintains its headquarters in Redmond,
21 Washington, has a significant presence in this District, and Defendant has advertised and derived
22 revenue from sales of products to citizens within this District and has engaged in systematic and
23 continuous business contact within this State. Defendant has had and continues to have
24 significant contact with the state of Washington through its U.S. based websites, through U.S.
25 based sales, and distribution of its OneDrive product and services throughout the U.S., and have
26 purposefully availed themselves of Washington's laws.

11. Upon information and belief, a number of Defendant's current and former employees with information relevant to this case reside in the Redmond, Washington area.

BACKGROUND

A. Plaintiff's Patented Technology

12. The use and importance of data backup and storage, and cloud storage in particular, have grown tremendously since the year 2000.

13. In 1999, a company called IPCI, Inc. (“IPCI”) set out to develop an automated, real-time zero-touch data safety, backup, and recovery software product. It called the project AccuSafe.

14. Unfortunately, the AccuSafe product was never marketed or sold, however, though the development process, IPCI secured a portfolio of patents (the “Patent Portfolio”) around the unique and novel technology.

15. On September 20, 2018, IPCI assigned its rights to the Patent Portfolio to Datanet, LLC (“Datanet”).

16. At a high level, the Patent Portfolio protects user files and describes systems and techniques for archiving and restoring files.

17. The Patent Portfolio consists of five issued U.S. Patents, U.S. Patent Nos. 8,473,478, 9,218,348, 10,229,123, 10,331,619, and 10,585,850.

18. U.S. Patent No. 8,473,478 (the “478 Patent”) was filed on September 21, 2001 and claims priority to U.S. Provisional Patent Application No. 60/234,221, filed on September 21, 2000.

19. The '478 Patent was granted an extended term through October 1, 2026.

20. U.S. Patent No. 9,218,348 (the “348 Patent”) was filed on June 24, 2013 as a continuation of the ‘478 Patent.

21. U.S. Patent No. 10,585,850 (the “‘850 Patent”) was filed on December 15, 2015 as a continuation of the ‘348 Patent.

1 22. The '850 Patent was granted an extended term though June 25, 2024.

2 23. U.S. Patent No. 10,229,123 (the "'123 Patent") was filed on October 20, 2017 as a
3 continuation of U.S. Patent No. 10,585,850.

4 24. U.S. Patent No. 10,331,619 (the "'619 Patent") was filed as a continuation of U.S.
5 Patent No. 10,585,850.

6 25. Before the development of the AccuSafe project, file backup procedures (manual
7 backup, schedule-based backup, and mirroring) were lacking in important ways, including: (1)
8 they were complex or confusing for users, (2) they did not record all the changes made and often
9 could not be reversed, and (3) they required the backup medium to be available at the time of
10 backup.

11 26. The Datanet Patent Portfolio provides significant advantages to the previous file
12 backup systems by providing, *inter alia*: (1) the ability to archive files, or portions of the files, in
13 close proximity of time to opening, closing, or saving the files, allowing for timely and full
14 backup for later recovery, (2) the ability to store files (or portions of files) for remote or cloud
15 backup when the storage location becomes available, and (3) the ability to preview prior versions
16 of a file before restoring a prior version, so that only desired backup versions of the files are
17 restored.

18 27. The claims of the Datanet portfolio are directed to improvements in computer
19 functionality when applied to data storage, and address the failings that are unique to data storage
20 networked environments. The Specifications of the patents in suit disclose that the inventions
21 relates to computer-specific improvements, viz. "file preservation, file capture, file management,
22 and file integrity techniques for computing devices," and addresses computer-specific problems
23 that arise given the ever-changing networked-data environment, through "captur[ing] files just
24 before and/or just after the files are changed," "hav[ing] an imperceptible impact on system
25 performance from the user's point of view," and "captur[ing] and stor[ing] files even when there
26

1 is no connection to the desired storage location ... [and/or] when the desired storage location is
2 unavailable.”

3 28. The ‘478 Patent solution improves computer functionality over prior data storage
4 approaches because it optimizes the use of various storage locations to capture changes to files in
5 real time (or near real time), along with database(s) to track the movement of the files between
6 the storage locations, so that previous versions of file(s) can be efficiently retrieved and restored,
7 without overburdening the network resources in the process.

8 29. The claims of the ‘478 patent recite specific interactions between hardware and
9 software computer components to accomplish the data backup and storage, and through these
10 interactions, the computer functionality is improved. The inventions claimed in the ‘478 patent
11 save user’s time, computer resources, and network bandwidth over prior approaches.

12 30. The ‘348 Patent solution improves computer functionality over prior data storage
13 approaches because it optimizes the use of various storage locations to capture changes to files in
14 real time (or near real time), along with database(s) to track the movement of the files between
15 the storage locations, so that previous versions of file(s) can be efficiently retrieved and restored,
16 without overburdening the network resources in the process.

17 31. The claims of the ‘348 patent recite specific interactions between hardware and
18 software computer components to accomplish the data backup and storage, and through these
19 interactions, the computer functionality is improved. The inventions claimed in the ‘348 patent
20 save user’s time, computer resources, and network bandwidth over prior approaches.

21 32. The ‘850 Patent solution improves computer functionality over prior data storage
22 approaches because it optimizes the use of various storage locations to capture changes to files in
23 real time (or near real time), along with database(s) to track the movement of the files between
24 the storage locations, so that previous versions of file(s) can be quickly previewed before being
25 efficiently retrieved and restored, all without overburdening the network resources in the process.

1 33. The claims of the '850 patent recite specific interactions between hardware and
2 software computer components to accomplish the data backup, presentation of previews, and the
3 storage of such, and through these interactions, the computer functionality is improved. The
4 inventions claimed in the '850 patent save user's time, computer resources, and network
5 bandwidth by avoiding the restoration of an unwanted previous version. The technique of
6 previewing multiple previous versions prior to restoring from network storage was not
7 conventional and was not well-understood at the time of the invention.

8 **B. Defendant's Infringement of the Asserted Patents**

9 34. Defendant was founded in 1975.

10 35. Upon information and belief, Defendant launched its flagship services called
11 OneDrive and OneDrive for Business in August 2007 (collectively referred herein as
12 "OneDrive").

13 36. OneDrive provides users with the ability to share, synchronize and backup their
14 files.

15 37. Upon information and belief, OneDrive is bundled with Microsoft Windows and
16 is available for use on a variety of platforms including Android, iOS, macOS, Windows Phone,
17 Xbox 360, Xbox One, Xbox Series X, and Xbox Series S.

18 38. In addition, upon information and belief, Microsoft Office directly integrates with
19 OneDrive.

20 39. Upon information and belief, OneDrive was called SkyDrive before the name was
21 changed in 2013.

22 40. Upon information and belief, OneDrive for Business was called SkyDrive Pro
23 before the name was changed in 2013.

24 41. Upon information and belief, since 2015, Defendant has provided a set amount of
25 free storage to each OneDrive user, which has typically ranged somewhere between five (5) and
26 fifteen (15) gigabytes.

42. Upon information and belief, each user of OneDrive may purchase up to one (1) terabyte of storage space on Defendant's server(s).

43. OneDrive provides the ability for a user to save previous versions of a file and then gives them the ability to restore a current version of a file to a previous version of the file by selecting one of the saved previous versions of the file.

44. Upon information and belief, prior to July 2017, OneDrive only saved previous versions of files for Microsoft Office files.

45. In July 2017, OneDrive expanded its version history support to all file types.

46. Older versions of files are stored for up to thirty (30) days with OneDrive.

47. OneDrive uses the inventions claimed in the '348, '478 and '850 Patents to provide file backup capabilities to more than 42.7 million registered users of Microsoft Office.

48. OneDrive provides users with the ability to archive files in close proximity of time to opening, updating, closing, or saving them.

49. Upon information and belief, OneDrive maintains servers for storage of its user data located in Redmond, Washington.

50. OneDrive provides users with the ability to store files for remote backup when storage media is available.

51. OneDrive protects user files from unwanted edits, deletions, hackers, and viruses by restoring or recovering files in each OneDrive account for up to thirty (30) days.

52. OneDrive provides users with the ability to preview prior versions of a file before restoring it.

53. OneDrive provides users with a viewer history.

FIRST CLAIM FOR RELIEF

(Infringement of the '478 Patent – 35 U.S.C. §271)

54. Plaintiff hereby incorporates by reference and realleges the foregoing paragraphs as if fully set forth herein.

1 55. Plaintiff is the current exclusive owner and assignee of all right, title, and interest
2 in and to the '478 Patent titled "Automatic Real-Time File Management Method and Apparatus".

3 56. The '478 Patent was duly and legally issued by the United States Patent and
4 Trademark Office on June 25, 2013.

5 57. Plaintiff owns all rights to the '478 Patent including the right to bring this suit for
6 damages.

7 58. A true and correct copy of the '478 patent is attached hereto as Exhibit A.

8 59. The '478 Patent is valid and enforceable.

9 60. Defendant has directly and indirectly infringed the '478 patent by making, using,
10 testing, selling, offering for sale, and/or importing into the United States, without authority,
11 products, methods performed by and/or attributable to equipment, and or services that practice
12 one or more claims of the '478 Patent, including but not limited to its OneDrive file hosting
13 product and services.

14 61. As a non-limiting example, Defendant has infringed Claims 1, 2, 3, 5, 6, 8, 9, 10
15 and 11 of the '478 Patent. Defendant, without authorization from Plaintiff, has marketed, used,
16 tested, offered for sale, sold, and/or imported into the U.S., including within this District, its
17 OneDrive file hosting service that infringes at least Claims 1, 2, 3, 5, 6, 8, 9, 10 and 11 of the
18 '478 Patent.

19 62. As a non-limiting example, set forth below (with claim language in italics) is a
20 description of infringement of exemplary Claims 1 and 6 of the '478 Patent in connection with
21 OneDrive. This description is based on publicly available information. Plaintiff reserves the right
22 to modify this description, including, for example, on the basis of information about OneDrive
23 that it obtains during discovery.

24 Claim 1.

25 *Claim 1. In a computing device, a* OneDrive automatically backs up local files (i.e.,
26 *method for archiving files comprising:* operating files and/or entire folders) to the one drive

cloud/server. When a file is added to the local computer OneDrive folder, a copy of the file (i.e. Archive file) is created in a temporary storage staging buffer (change to send queue) to facilitate sending to the cloud/server. The file in the OneDrive server is an archive file of the operating file, synchronized from the local file. If any changes are made to the local file, the changes get synchronized to the OneDrive archive file.

[Https://support.office.com/en-us/article/sync-files-with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us.](https://support.office.com/en-us/article/sync-files-with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us)

The OneDrive service monitors the OneDrive folder on your computer and/or your OneDrive mobile app. If there's a change – a new file or folder, or an edit to an existing file or folder – OneDrive will automatically sync those changes. No manual uploading or downloading is required.

[Https://support.office.com/en-us/article/sync-files-with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us.](https://support.office.com/en-us/article/sync-files-with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us)

The method steps for archiving files using OneDrive are performed on a computing device such as a computer or handheld phone.

1 *Detecting an instruction by an
2 operating system to perform an
3 operation on an operating file;*

OneDrive monitors changes made in files, and upon detecting a change in a file, OneDrive provides an instruction to save the modified file as an archived file. OneDrive detects the instruction to change/save the file. The windows notification service monitors the users file and provides an instruction upon detecting a change in a file, and OneDrive detects the instruction from the windows notification system to start the back-up process.

<http://go.microsoft.com/fwlink/?LinkId=829044>

11 *Creating an archive file from the
12 operating file and storing the archive
13 file in a temporary first storage
14 location temporally proximate to the
15 operation being performed on the
16 operating file and responsive to
17 detecting the instruction;*

After detection of, and in response to the instruction to begin the back-up process, which occurs as soon as or shortly after a change in the file is made, a portion or all of the operating file is processed to create an archive file which is saved in a “change to send” queue. OneDrive uses windows notification system to detect and archive changes to files in real time. The windows notification system informs the OneDrive sync application to activate whenever a change to a file actually happens. Depending on the changes being made to a file, OneDrive may break the file into different sized pieces to create the archive file that is temporarily stored in the change to send queue (first temporary storage location).

<http://go.microsoft.com/fwlink/?LinkId=829044>.

1 *Searching the first temporary storage
2 location for the archive file responsive
3 to the occurrence of a first event; and*

Once the archive file is moved into the change to send queue (first event), the archive files are identified so that they can be searched to determine their size/types before being sent to the OneDrive cloud server. This identification process can be the first event, or the first event can be a message from the operating process that created the archive file to indicate it is done, or a message from a timer to search the change to send queue. In response to the first event, the change to send queue (first temporary storage location) is searched in order to determine the archive file size/type prior to being sent to the OneDrive cloud server.

14 [Http://go.microsoft.com/fwlink/?LinkId=829044](http://go.microsoft.com/fwlink/?LinkId=829044).

15 *Moving the archive file to a second
16 storage location responsive to a
17 second event, the second storage
18 location being a permanent storage
19 location;*

The files (i.e., archived files) are transmitted (moved) from a user's computer (i.e., local device) to the OneDrive cloud server (the second, permanent storage location). When the identified archived file has a larger size, then it is divided into chunks for uploading. After dividing the file into smaller chunks (if needed), one by one, these chunks are transmitted from the change to send queue (first temporary storage) to the OneDrive cloud server (permanent storage) in response to a different second event that indicates the OneDrive server is ready to receive data. File transmission only occurs in response to a

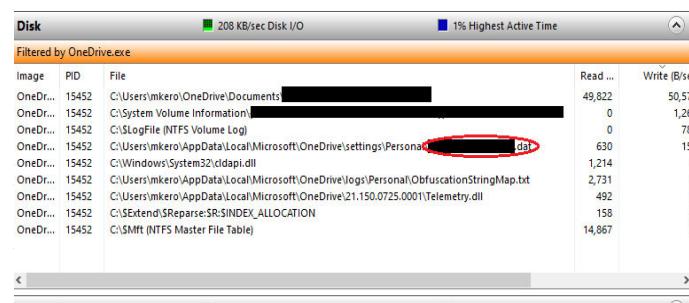
1 message from the OneDrive cloud server that it can
 2 receive data (second event).

3 <http://go.microsoft.com/fwlink/?LinkId=829044>.
 4 <https://support.office.com/en-us/article/change-the->
 5 <https://support.office.com/en-us/article/change-the-one-drive-sync-app-upload-or-download-rate-71cc69da-2371-4981-8cc8-b4558bdda56e?ui=en-us&rs=en-us&ad=us>.

6
 7
 8 *After storing the archive file in the first temporary storage location, updating a database to indicate that the archive file is located in the first temporary storage location;*
 9
 10
 11
 12

After storing the archive file in the change to send queue, OneDrive updates a OneDrive database, upon information and belief “<cid>.dat” database, “metadata” database and/or “auto_upload.db” database to indicate the archive file is in the first temporary storage location.

13
 14 [Http://go.microsoft.com/fwlink/?LinkId=829044](http://go.microsoft.com/fwlink/?LinkId=829044)
 15 (see also [private app storage
 16 path]/database/metadata; [private app storage
 17 path]/database/auto_upload.db)



Determining a final destination for the archive file;

The archive file is determined and stored in one or more encrypted file chunks in the azure storage as the final destination, with metadata pointers to the azure storage on the OneDrive cloud server.

Moving the archive file from the first temporary storage location to an intermediate storage location;

<http://go.microsoft.com/fwlink/p/?linkid=829044>

OneDrive moves the archive file from the change to send queue to an output buffer, or a local cache, an external cache, or an intermediary server (intermediate storage location); before it moves the archive file into a final destination such as the azure storage on the OneDrive cloud server.

Updating the database to indicate that the archive file is located in the intermediate storage location; and

The OneDrive database is updated with “loadingprogress” data which tracks whether data transfer to the cloud has taken place for any given archive file, the progress of such transfer, and the progress of the output buffer, the local cache, the external cache, or the intermediary server.

After moving the archive file to the second storage location, updating the database to indicate that the archive file is located in the second storage location.

When an archive file is being moved to the azure storage, OneDrive shows a blue icon to indicate the archive file is being transferred to azure storage (i.e., from the output buffer, the local cache, the external cache, or the intermediary server). When the archive file has been moved into the azure storage (i.e., has been transferred to the final destination), the OneDrive database is updated and a green icon is shown at the client side instead of the blue icon.

Claim 6.

*An article of manufacture comprising
a non-transitory computer useable
medium having computer readable*

Defendant hosts a computer server storing a computer executable application (called OneDrive) that has computer readable code that performs the

code for performing the method of steps of claim 1, as detailed above.

claim 1. (<https://www.microsoft.com/en-us/microsoft-365/onedrive/download>).

63. As described above, Defendant's products or services infringe the '478 Patent.

64. Defendant's OneDrive service includes a program which can be installed on a computer.

65. Defendant's OneDrive program detects instructions to perform operation(s) on files.

66. When an instruction is detected, Defendant's OneDrive program creates an archived version of the file being stored or modified and stores the archives file in a temporary storage location.

67. Defendant's OneDrive service records in a database the location of the archived file in the temporary storage location.

68. Later, the archived file is moved to a second storage location.

69. Defendant's OneDrive service records in the database the location of the archived file in the second storage location.

70. Defendant has actual knowledge of Plaintiff's rights in the '478 Patent and details of OneDrive's infringement of the '478 Patent based on at least the filing and service of this Complaint.

71. By the foregoing acts, including its testing and use of OneDrive, Defendant has directly infringed, literally and/or under the doctrine of equivalents, the '478 Patent in violation of 35 U.S.C. § 271.

72. Defendant has knowledge of the '478 Patent and indirectly infringes the '478 Patent by active inducement under 35 U.S.C. § 271(b) and/or § 271(f). Defendant has induced, caused, urged, encouraged, aided and abetted its direct and indirect customers to make, use, test, sell, offer for sale and/or import accused products and/or services. Defendant has done so by acts

1 including but not limited to selling accused products and/or services to its customers; marketing
 2 accused products and/or services; and providing instructions, technical support, and other
 3 support and encouragement (available at <https://support.microsoft.com/en-us/office/back-up-your-documents-pictures-and-desktop-folders-with-onedrive-d61a7930-a6fb-4b95-b28a-6552e77c3057>, or <https://support.microsoft.com/en-US/search/results?query=restore+file+from+backup+OneDrive&isEnrichedQuery=true>, for
 4 instance) for the use of accused products and/or services. Such conduct by Defendant was
 5 intended to and actually resulted in direct infringement, including the making, testing, using,
 6 selling, offering for sale, and/or importation of accused products and/or services in the United
 7 States.

8 73. Defendant has knowledge of the '478 Patent and indirectly infringes by
 9 contributing to the infringement of, and continuing to contribute to the infringement of, one or
 10 more claims of the '478 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for
 11 sale, and/or importing into the United States, the accused products and/or services. Defendant
 12 knows that the accused products and/or services include hardware components and software
 13 instructions that work in concert to perform specific, intended functions. Such specific, intended
 14 functions, carried out by these hardware and software combinations, are a material part of the
 15 inventions of the '478 Patent and are not staple articles of commerce suitable for substantial non-
 16 infringing use.

17 74. Upon information and belief, Defendant's infringement has, and continues to be,
 18 knowing, intentional and willful.

19 75. Defendant's acts of infringement of the '478 Patent has caused, and will continue
 20 to cause, Plaintiff damages for which Plaintiff is entitled to compensation pursuant to 35 U.S.C.
 21 § 284.

22 76. Upon information and belief, Defendant has gained profits by virtue of its
 23 infringement of the '478 Patent.

77. The circumstances surrounding Defendant's infringement are exceptional and, therefore, Plaintiff is entitled to an award of attorney's fees pursuant to 35 U.S.C. § 285.

SECOND CLAIM FOR RELIEF

(Infringement of the '348 Patent – 35 U.S.C. §271)

78. Plaintiff hereby incorporates by reference and realleges the foregoing paragraphs as if fully set forth herein.

79. Plaintiff is the current exclusive owner and assignee of all right, title, and interest in and to the '348 Patent titled "Automatic Real-Time File Management Method and Apparatus".

80. The '348 Patent was duly and legally issued by the United States Patent and Trademark Office on December 22, 2015.

81. Plaintiff owns all rights to the '348 Patent including the right to bring this suit for damages.

82. A true and correct copy of the '348 Patent is attached hereto as Exhibit B.

83. Before its expiration, the '348 Patent was valid and enforceable.

84. Defendant has directly and indirectly infringed the '348 patent by making, using, testing, selling, offering for sale, and/or importing into the United States, without authority, products, methods performed by and/or attributable to equipment, and or services that practice one or more claims of the '348 Patent, including but not limited to its OneDrive file hosting product and services.

85. As a non-limiting example, Defendant has infringed Claims 1, 3, 4, 5, 6, 8, 10 – 20, and 23 – 31 of the '348 Patent. Defendant, without authorization from Plaintiff, has marketed, tested, used, offered for sale, sold, and/or imported into the U.S., including within this District, its OneDrive file hosting service that infringes at least Claims 1, 3, 4, 5, 6, 8, 10 – 20, and 23 – 31 of the '348 Patent.

86. As a non-limiting example, set forth below (with claim language in *italics*) is a description of infringement of exemplary Claims 15 and 29 of the '348 Patent in connection with

1 OneDrive. This description is based on publicly available information. Plaintiff reserves the right
 2 to modify this description, including, for example, on the basis of information about OneDrive
 3 that it obtains during discovery.

4 Claim 15

5 *A method for archiving files, comprising
 6 of steps (a) to (d) following:*

OneDrive automatically backs up local files (i.e.,
 operating files and/or entire folders) to the one
 drive cloud/server. When a file is added to the
 local computer OneDrive folder, a copy of the file
 (i.e. Archive file) is created in a temporary storage
 staging buffer (change to send queue) to facilitate
 sending to the cloud/server. The file in the
 OneDrive server is an archive file of the operating
 file, synchronized from the local file. If any
 changes are made to the local file, the changes get
 synchronized to the OneDrive archive file.

<https://support.office.com/en-us/article/sync-files-with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us>.

The OneDrive service monitors the OneDrive
 folder on your computer and/or your OneDrive
 mobile app. If there's a change – a new file or
 folder, or an edit to an existing file or folder –
 OneDrive will automatically sync those changes.
 No manual uploading or downloading is required.

<https://support.office.com/en-us/article/sync-files-with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us>

1 [with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us](https://www.onedrive.com/with-onedrive-in-windows-615391c4-2bd3-4aae-a42a-858262e42a49?ui=en-us&rs=en-us&ad=us).

2
3 The method steps for archiving files using
4 OneDrive are performed on a computing device
5 such as a computer or handheld phone.

6 *(a) the step of detecting an instruction by
7 a resident program in a computing
8 device for performing an operation on
9 an operating file;*

10 OneDrive monitors changes made in files, and
11 upon detecting a change in a file, OneDrive
12 provides an instruction to save the modified file as
13 an archived file. OneDrive detects the instruction
14 to save the file. The windows notification service
15 monitors the users file and provides an instruction
16 upon detecting a change in a file, and OneDrive
17 detects the instruction from the windows
18 notification system to start the back-up process.

<http://go.microsoft.com/fwlink/?linkid=829044>

19 *(b) the step of creating an archive file
20 from the operating file and storing the
21 archive file in a temporary storage
22 location temporally proximate to the
23 operation being performed on the
24 operating file and responsive to
25 detecting the instruction;*

26 After detection of, and in response to the
instruction to begin the back-up process, which
occurs as soon as or shortly after a change in the
file is made, a portion or all of the operating file is
processed to create an archive file which is saved
to a “change to send” queue. OneDrive uses
windows notification system to detect and archive
changes to files in real time. The windows
notification system informs the OneDrive sync
application to activate whenever a change to a file
actually happens. Depending on the changes being

made to a file, OneDrive may break the file into different sized pieces to create the archive file that is temporarily stored in the change to send queue (first temporary storage location).

<http://go.microsoft.com/fwlink/?LinkId=829044>

(c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event; and

Once the archive file is moved into the change to send queue (first event), the archive files are identified so that they can be searched to determine their size/types before being sent to the OneDrive cloud server. This identification process can be the first event, or the first event can be a message from the operating process that created the archive file to indicate it is done, or a message from a timer to search the change to send queue. In response to the first event, the change to send queue (first temporary storage location) is searched in order to identify the presence of the archive file, and its size/type prior to being sent to the OneDrive cloud server.

[Http://go.microsoft.com/fwlink/?LinkId=829044](http://go.microsoft.com/fwlink/?LinkId=829044)

(d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location,

When the identified archived file has a larger size, then it is divided into chunks for uploading. After dividing the file into smaller chunks (if needed), one by one, these chunks are transmitted from the change to send queue (first temporary storage) to the OneDrive cloud server (permanent storage) in

wherein the first event is different from the second event.

response to a different second event that either indicates the OneDrive server is ready to receive data, or indicates which blocks to send. After OneDrive determines (second event) which files or blocks (archive file) are different than what it already has saved, the archive file is then transmitted to an output buffer, or a local cache, and external cache, or an intermediary server (intermediate storage location), or to the OneDrive server (permanent storage) in response to the second event.

Claim 29

A non-transitory computer readable medium comprising program instruction for performing the method of claim 15.

Defendant hosts a computer server storing a computer executable application (called OneDrive) that has computer readable code that performs the method steps of claim 15, as detailed above (<https://www.microsoft.com/en-us/microsoft-365/onedrive/download>).

87. As described above, Defendant's products or services infringe the '348 Patent.

88. Defendant's OneDrive service includes a program which can be installed on a computer or computing device.

89. Defendant's OneDrive program detects instructions to perform operation(s) files.

90. When an instruction is detected, Defendant's OneDrive program creates an archived version of the file being modified and stores the archives file in a temporary storage location.

91. Later, the archived file is moved to another storage location.

1 92. Defendant has actual knowledge of Plaintiff's rights in the '348 Patent and details
 2 of OneDrive's infringement of the '348 Patent based on at least the filing and service of this
 3 Complaint.

4 93. By the foregoing acts, including its testing and use of OneDrive, Defendant has
 5 directly infringed, literally and/or under the doctrine of equivalents, the '348 Patent in violation
 6 of 35 U.S.C. § 271.

7 94. Defendant has knowledge of the '348 Patent and indirectly infringes the '348
 8 Patent by active inducement under 35 U.S.C. § 271(b) and/or § 271(f). Defendant has induced,
 9 caused, urged, encouraged, aided and abetted its direct and indirect customers to make, test, use,
 10 sell, offer for sale and/or import accused products and/or services. Defendant has done so by acts
 11 including but not limited to selling accused products and/or services to its customers; marketing
 12 accused products and/or services; and providing instructions, technical support, and other
 13 support and encouragement (available at <https://support.microsoft.com/en-us/office/back-up-your-documents-pictures-and-desktop-folders-with-onedrive-d61a7930-a6fb-4b95-b28a-6552e77c3057>, or <https://support.microsoft.com/en-US/search/results?query=restore+file+from+backup+OneDrive&isEnrichedQuery=true>, for
 14 instance) for the use of accused products and/or services. Such conduct by Defendant was
 15 intended to and actually resulted in direct infringement, including the making, testing, using,
 16 selling, offering for sale, and/or importation of accused products and/or services in the United
 17 States.

21 95. Defendant has knowledge of the '348 Patent and indirectly infringes by
 22 contributing to the infringement of, and continuing to contribute to the infringement of, one or
 23 more claims of the '348 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for
 24 sale, and/or importing into the United States, the accused products and/or services. Defendant
 25 knows that the accused products and/or services include hardware components and software
 26 instructions that work in concert to perform specific, intended functions. Such specific, intended

1 functions, carried out by these hardware and software combinations, are a material part of the
2 inventions of the '348 Patent and are not staple articles of commerce suitable for substantial non-
3 infringing use.

4 96. Upon information and belief, Defendant's infringement was knowing, intentional
5 and willful.

6 97. Defendant's acts of infringement of the '348 Patent has caused Plaintiff damages
7 for which Plaintiff is entitled to compensation pursuant to 35 U.S.C. § 284.

8 98. Upon information and belief, Defendant has gained profits by virtue of its
9 infringement of the '348 Patent.

10 99. The circumstances surrounding Defendant's infringement are exceptional and,
11 therefore, Plaintiff is entitled to an award of attorney's fees pursuant to 35 U.S.C. § 285.

12 **THIRD CLAIM FOR RELIEF**

13 **(Infringement of the '850 Patent – 35 U.S.C. §271)**

14 100. Plaintiff hereby incorporates by reference and realleges the foregoing paragraphs
15 as if fully set forth herein.

16 101. Plaintiff is the current exclusive owner and assignee of all right, title, and interest
17 in and to the '850 Patent titled "Automatic Real-Time File Management Method and Apparatus".

18 102. The '850 Patent was duly and legally issued by the United States Patent and
19 Trademark Office on March 10, 2020.

20 103. Plaintiff owns all rights to the '850 Patent including the right to bring this suit for
21 damages.

22 104. A true and correct copy of the '850 patent is attached hereto as Exhibit C.

23 105. The '850 Patent is valid and enforceable.

24 106. Defendant has directly and indirectly infringed the '850 patent by making, using,
25 testing, selling, offering for sale, and/or importing into the United States, without authority,
26 products, methods performed by and/or attributable to equipment, and or services that practice

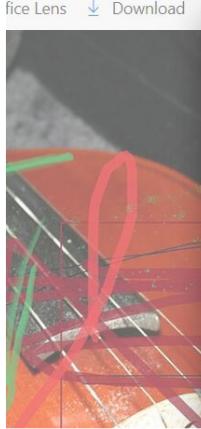
1 one or more claims of the '850 Patent, including but not limited to its OneDrive file hosting
 2 product and services.

3 107. As a non-limiting example, Defendant has infringed Claims 1 – 18 of the '850
 4 Patent. Defendant, without authorization from Plaintiff, has marketed, used, tested, offered for
 5 sale, sold, and/or imported into the U.S., including within this District, its OneDrive file hosting
 6 service that infringes at least Claim 1 – 21 of the '850 Patent.

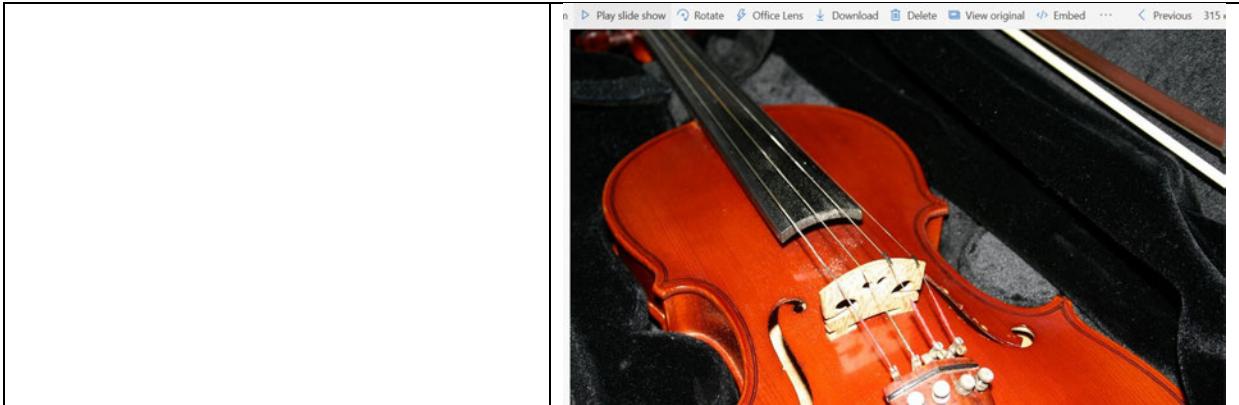
7 108. As a non-limiting example, set forth below (with claim language in italics) is a
 8 description of infringement of exemplary Claim 10 of the '850 Patent in connection with
 9 OneDrive. This description is based on publicly available information. Plaintiff reserves the right
 10 to modify this description, including, for example, on the basis of information about OneDrive
 11 that it obtains during discovery.

12 **Claim 10**

<p>13 <i>A method of restoring a file to a</i> 14 <i>previous version of the file, a current</i> 15 <i>version of the file being available at a</i> 16 <i>local storage location, comprising the</i> 17 <i>steps of:</i></p>	<p>OneDrive provides a method for users to restore a file to a previous version from the current version. The current version of the file is stored locally on the user's computer.</p>
<p>19 <i>(A) presenting information for a</i> 20 <i>collection of one or more previous</i> 21 <i>versions of the file, the information for</i> 22 <i>the collection including information</i> 23 <i>indicative of at least one or more of</i> 24 <i>previous versions of the file, wherein a</i> 25 <i>restorable representation of each</i> 26 <i>version, V, of the previous versions, is</i></p>	<p>OneDrive maintains a Version History of a given file. When a user selects to view the Version History of a document, OneDrive displays the previous versions of the file to the user via their web interface. Previous versions are stored remotely from the user's computer on OneDrive's server. Each previous version is available for selection for previewing and/or restoring the current</p>

<p>1 <i> retrievable from a remote storage</i> 2 <i> location, the restorable representation</i> 3 <i> having at least information required for</i> 4 <i> recovering the version V, the remote</i> 5 <i> storage location being accessible</i> 6 <i> through a network;</i></p>	<p>version via the web interface. When selected, OneDrive retrieves the selected previous version from the remote storage and restores the current version of the file to its previous version.</p> <p></p> <p>Version History</p> <table border="1"> <thead> <tr> <th>Modified Date</th> <th>Modified By</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>3m ago</td> <td>[REDACTED]</td> <td>1.48 MB</td> </tr> <tr> <td>3m ago</td> <td>[REDACTED]</td> <td>1.42 MB</td> </tr> <tr> <td>5m ago</td> <td>[REDACTED]</td> <td>2.74 MB</td> </tr> </tbody> </table>	Modified Date	Modified By	Size	3m ago	[REDACTED]	1.48 MB	3m ago	[REDACTED]	1.42 MB	5m ago	[REDACTED]	2.74 MB
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3m ago	[REDACTED]	1.42 MB											
5m ago	[REDACTED]	2.74 MB											
<p>12 <i>(B) responsive to a selection to preview</i> 13 <i>a selected previous version of the file</i> 14 <i>based on the presented information for</i> 15 <i>the collection of (A), presenting a</i> 16 <i>presentable representation of the</i> 17 <i>selected previous version, the selected</i> 18 <i>previous version being one of the</i> 19 <i>previous versions of the file in the</i> 20 <i>presented information for the</i> 21 <i>collection, the presentable</i> 22 <i>representation having at least</i> 23 <i>information required for presenting at</i> 24 <i>least a portion of the selected previous</i> 25 <i>version;</i></p>	<p>For each previous version that is clicked on by the user, the user can open (download/open) the file to preview at least a portion of the previous version of the file, as shown below in screen shots.</p> <p></p> <p>Version History</p> <table border="1"> <thead> <tr> <th>Modified Date</th> <th>Modified By</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>3m ago</td> <td>[REDACTED]</td> <td>1.48 MB</td> </tr> <tr> <td>3m ago</td> <td>[REDACTED]</td> <td>1.42 MB</td> </tr> <tr> <td>5m ago</td> <td>[REDACTED]</td> <td>2.74 MB</td> </tr> </tbody> </table>	Modified Date	Modified By	Size	3m ago	[REDACTED]	1.48 MB	3m ago	[REDACTED]	1.42 MB	5m ago	[REDACTED]	2.74 MB
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	 <p>Version History</p> <table border="1"> <thead> <tr> <th>Modified Date</th> <th>Modified By</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>35m ago</td> <td></td> <td>Opening IMG_1801.jpg</td> </tr> <tr> <td>36m ago</td> <td></td> <td>You have chosen to open: IMG_1801.jpg which is: JPG file (2.7 MB) from: https://public.sn.files.1drv.com</td> </tr> <tr> <td>37m ago</td> <td></td> <td></td> </tr> </tbody> </table> <p>What should Firefox do with this file?</p> <p><input checked="" type="radio"/> Open with Photos (default)</p> <p><input type="radio"/> Save File</p> <p><input type="checkbox"/> Do this automatically for files like this from now on.</p> <p>OK Cancel</p>	Modified Date	Modified By	Size	35m ago		Opening IMG_1801.jpg	36m ago		You have chosen to open: IMG_1801.jpg which is: JPG file (2.7 MB) from: https://public.sn.files.1drv.com	37m ago								
Modified Date	Modified By	Size																	
35m ago		Opening IMG_1801.jpg																	
36m ago		You have chosen to open: IMG_1801.jpg which is: JPG file (2.7 MB) from: https://public.sn.files.1drv.com																	
37m ago																			
<p>9 (C) responsive to a selection to restore 10 the selected previous version, retrieving 11 the restorable representation of the 12 selected previous version from the 13 remote storage location and storing the 14 selected previous version as the current 15 version on the local storage location, 16 the selected previous version available 17 from the restorable representation of 18 the selected previous version.</p>	<p>The user can select which previous version it wishes to restore and clicks the restore button to indicate its selection of the previous version.</p>  <p>Version History</p> <table border="1"> <thead> <tr> <th>Modified Date</th> <th>Modified By</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>Just now</td> <td></td> <td>1.42 MB</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td>43m ago</td> <td></td> <td>1.42 MB</td> </tr> <tr> <td>45m ago</td> <td></td> <td>2.74 MB</td> </tr> </tbody> </table> <p>OneDrive then retrieves the selected previous version from the OneDrive server and restores the current file back to the particular selected previous version. The restored file is then stored locally on the user's computer.</p>	Modified Date	Modified By	Size	Just now		1.42 MB							43m ago		1.42 MB	45m ago		2.74 MB
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Just now		1.42 MB																	
43m ago		1.42 MB																	
45m ago		2.74 MB																	



109. As described above, Defendant's products or services infringe the '850 Patent.

110. Defendant's OneDrive service allows for restoring a file to a previous version of
9 the file.

111. Defendant's OneDrive service maintains current version of files at a local storage
11 location.

112. Defendant's OneDrive service maintains information for previous versions of
13 files.

113. Defendant's OneDrive service allows for retrieving a version of files from a
15 remote storage location.

114. Defendant has actual knowledge of Plaintiff's rights in the '850 Patent and details
17 of OneDrive's infringement of the '850 Patent based on at least the filing and service of this
18 Complaint.

115. By the foregoing acts, including its testing and use of OneDrive, Defendant has
20 directly infringed, literally and/or under the doctrine of equivalents, the '850 Patent in violation
21 of 35 U.S.C. § 271.

116. Defendant has knowledge of the '850 Patent and indirectly infringes the '850
23 Patent by active inducement under 35 U.S.C. § 271(b) and/or § 271(f). Defendant has induced,
24 caused, urged, encouraged, aided and abetted its direct and indirect customers to make, test, use,
25 sell, offer for sale and/or import accused products and/or services. Defendant has done so by acts
26 including but not limited to selling accused products and/or services to its customers; marketing

1 accused products and/or services; and providing instructions, technical support, and other
 2 support and encouragement (available at <https://support.microsoft.com/en-us/office/back-up-your-documents-pictures-and-desktop-folders-with-onedrive-d61a7930-a6fb-4b95-b28a-6552e77c3057>, or <https://support.microsoft.com/en-US/search/results?query=restore+file+from+backup+OneDrive&isEnrichedQuery=true>, for
 3 instance) for the use of accused products and/or services. Such conduct by Defendant was
 4 intended to and actually resulted in direct infringement, including the making, testing, using,
 5 selling, offering for sale, and/or importation of accused products and/or services in the United
 6 States.

10 117. Defendant has knowledge of the '850 Patent and indirectly infringes by
 11 contributing to the infringement of, and continuing to contribute to the infringement of, one or
 12 more claims of the '850 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for
 13 sale, and/or importing into the United States, the accused products and/or services. Defendant
 14 knows that the accused products and/or services include hardware components and software
 15 instructions that work in concert to perform specific, intended functions. Such specific, intended
 16 functions, carried out by these hardware and software combinations, are a material part of the
 17 inventions of the '850 Patent and are not staple articles of commerce suitable for substantial non-
 18 infringing use.

19 118. Upon information and belief, Defendant's infringement has, and continues to be,
 20 knowing, intentional and willful.

21 119. Defendant's acts of infringement of the '850 Patent has caused, and will continue
 22 to cause, Plaintiff damages for which Plaintiff is entitled to compensation pursuant to 35 U.S.C.
 23 § 284.

24 120. Upon information and belief, Defendant has gained profits by virtue of its
 25 infringement of the '850 Patent.

121. The circumstances surrounding Defendant's infringement are exceptional and, therefore, Plaintiff is entitled to an award of attorney's fees pursuant to 35 U.S.C. § 285.

DEMAND FOR JURY TRIAL

122. Pursuant to Federal Rule of Civil Procedure 38(b), Plaintiff respectfully demands a jury trial of all issues triable to a jury in this action.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff prays for judgment against Defendant as follows:

- A. A judgment and order adjudicating and declaring that Defendant has directly infringed the '478 Patent, literally or under the doctrine of equivalents;
- B. A judgment and order adjudicating and declaring that Defendant has indirectly infringed the '478 Patent by inducing and/or contributing to its customers' infringement.
- C. A judgment and order adjudicating and declaring that Defendant has directly infringed the '348 Patent, literally or under the doctrine of equivalents;
- D. A judgment and order adjudicating and declaring that Defendant has indirectly infringed the '348 Patent by inducing and/or contributing to its customers' infringement.
- E. A judgment and order adjudicating and declaring that Defendant has directly infringed the '850 Patent, literally or under the doctrine of equivalents;
- F. A judgment and order adjudicating and declaring that Defendant has indirectly infringed the '850 Patent by inducing and/or contributing to its customers' infringement.
- G. A judgment and order that Defendant must account for and pay actual damages (but no less than a reasonable royalty), to Plaintiff for Defendant's infringement of the '478 Patent, the '348 Patent and/or the '850 Patent, including supplemental damages for any continuing post-verdict infringement up until entry of the final

1 judgment and an award of an ongoing royalty for Defendant's post-judgment
2 infringement in an amount according to proof in the event that a permanent
3 injunction preventing future acts of infringement is not granted;

4 H. A determination that this case is exceptional under 35 U.S.C. § 285;
5 I. A judgment and order awarding Plaintiff its reasonable attorneys' fees;
6 J. A judgment and order awarding Plaintiff its costs, expenses, and interest,
7 including pre-judgment and post-judgment, as provided for by 35 U.S.C. § 284;
8 K. A judgment and order that Defendant's infringement has been willful and an
9 award of treble damages pursuant to 35 U.S.C. § 284;
10 L. A judgment and order awarding pre-judgment and post-judgment interest on each
11 and every monetary award; and
12 M. Granting Plaintiff any such other and further relief as this Court deems just and
13 proper, or that Plaintiff may be entitled to as a matter of law or equity.

14 DATED this 31st day of October, 2022.

15 BYRNES KELLER CROMWELL LLP

16 By /s/ Bradley S. Keller
17 Bradley S. Keller, WSBA #10665

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25 26 Gregory P. Sitrick (*pro hac vice* forthcoming)
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icrum@messner.com
Attorneys for Plaintiff Datanet LLC

EXHIBIT A



US008473478B2

(12) **United States Patent**
Roach et al.

(10) **Patent No.:** **US 8,473,478 B2**
(b4) **Date of Patent:** **Jun. 25, 2013**

(54) **AUTOMATIC REAL-TIME FILE
MANAGEMENT METHOD AND APPARATUS**

(76) Inventors: **Warren Roach**, Colorado Springs, CO (US); **Steven R. Williams**, Colorado Springs, CO (US); **Troy J. Reiber**, Colorado Springs, CO (US); **Steven C. Burdine**, Middleton, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1836 days.

(21) Appl. No.: **09/957,459**

(22) Filed: **Sep. 21, 2001**

(65) **Prior Publication Data**

US 2002/0065837 A1 May 30, 2002

Related U.S. Application Data

(60) Provisional application No. 60/234,221, filed on Sep. 21, 2000.

(51) **Int. Cl.**
G06F 17/30 (2006.01)

(52) **U.S. Cl.**
USPC 707/707

(58) **Field of Classification Search**
USPC 707/203, 204, 200, 201, 102, 202
See application file for complete search history.

(56)

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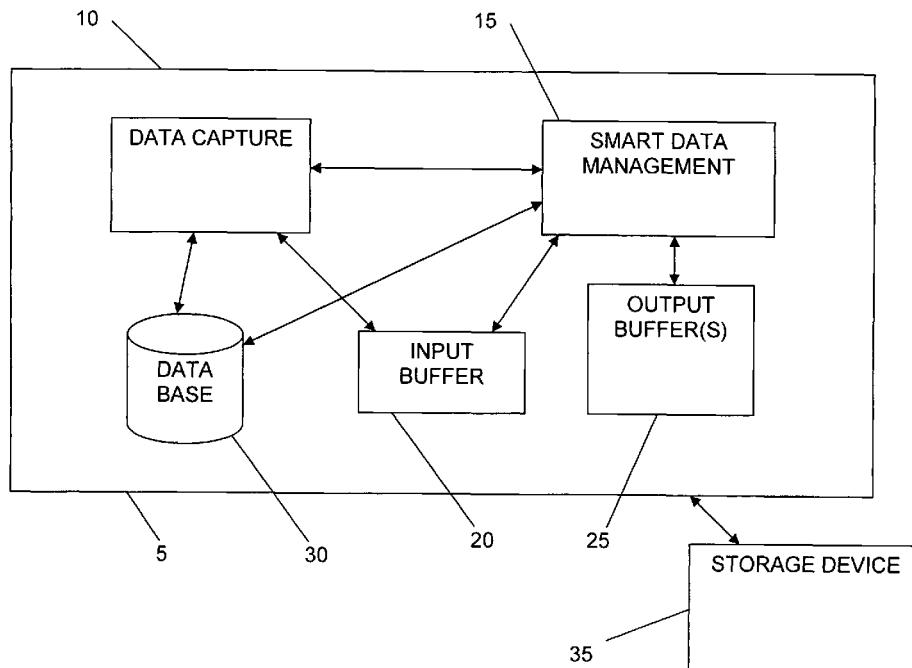
Primary Examiner — Baoquoc N To

(74) *Attorney, Agent, or Firm* — Cahn & Samuels, LLP

(57) **ABSTRACT**

A method for archiving files includes determining when a change in an operating file is imminent, capturing the operating file immediately before the change in the operating file occurs, if the operating file has not already been captured; and capturing the operating file immediately after the change in the operating file has occurred.

11 Claims, 6 Drawing Sheets



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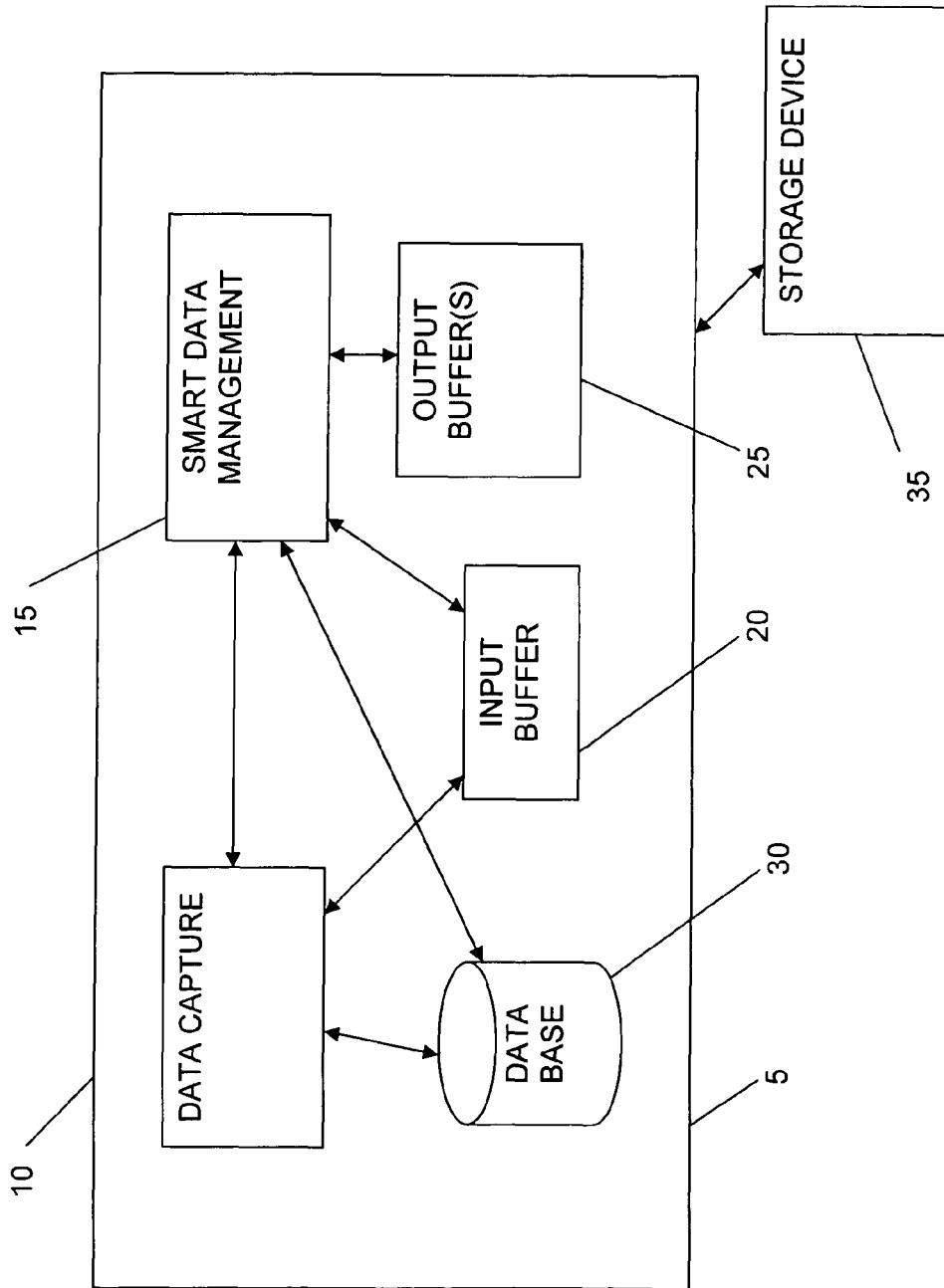


FIGURE 1

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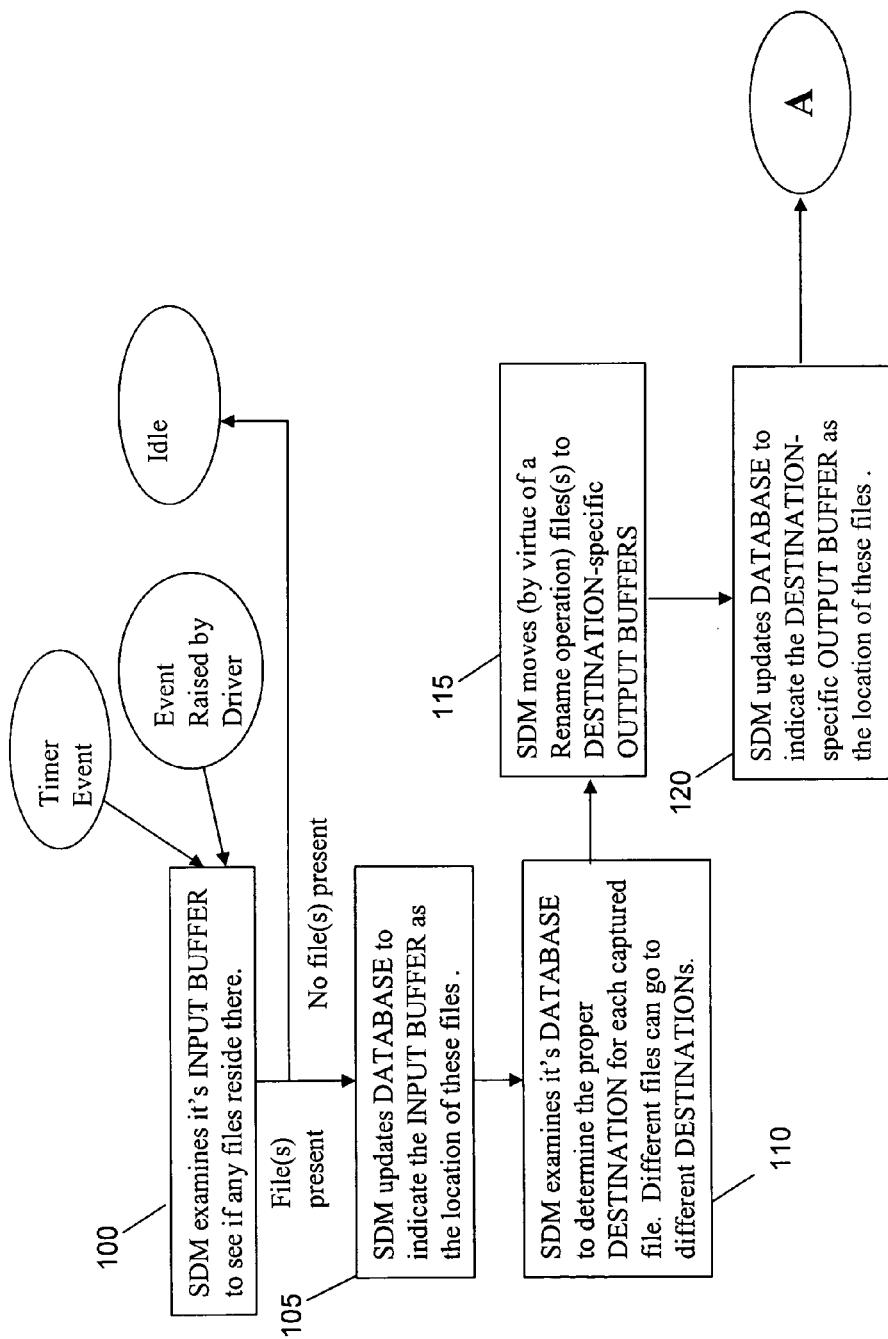


FIGURE 2A

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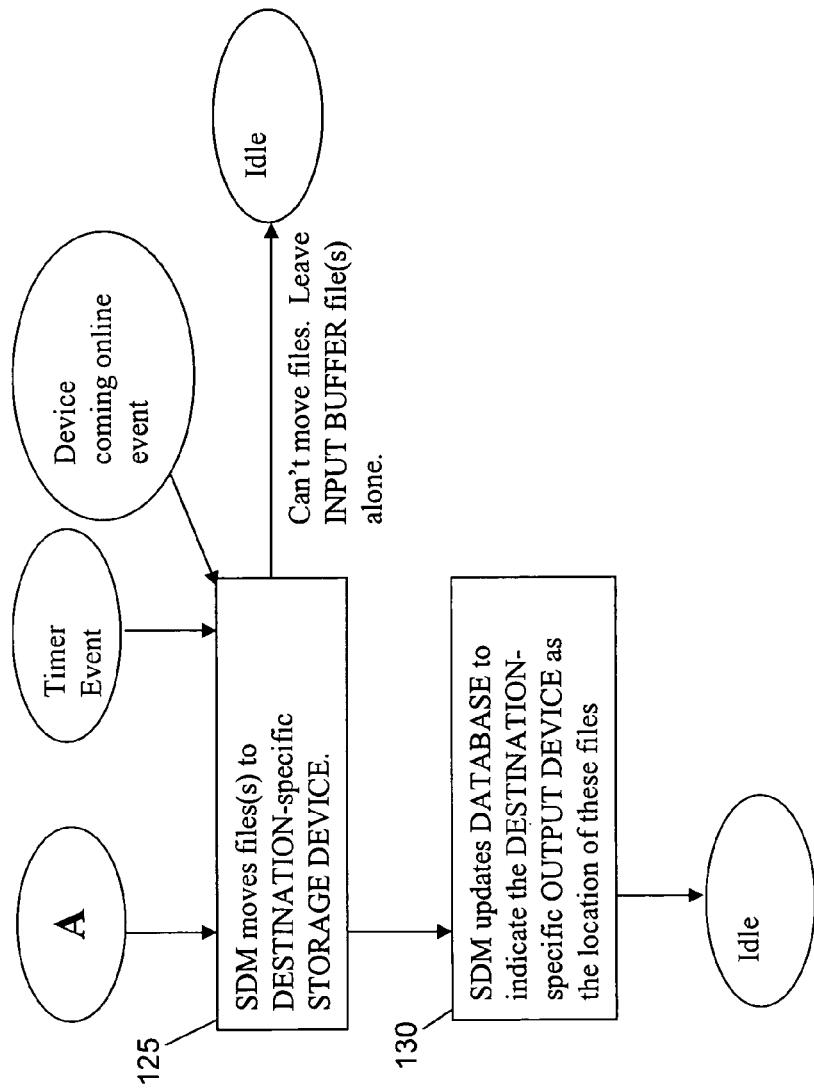


FIGURE 2B

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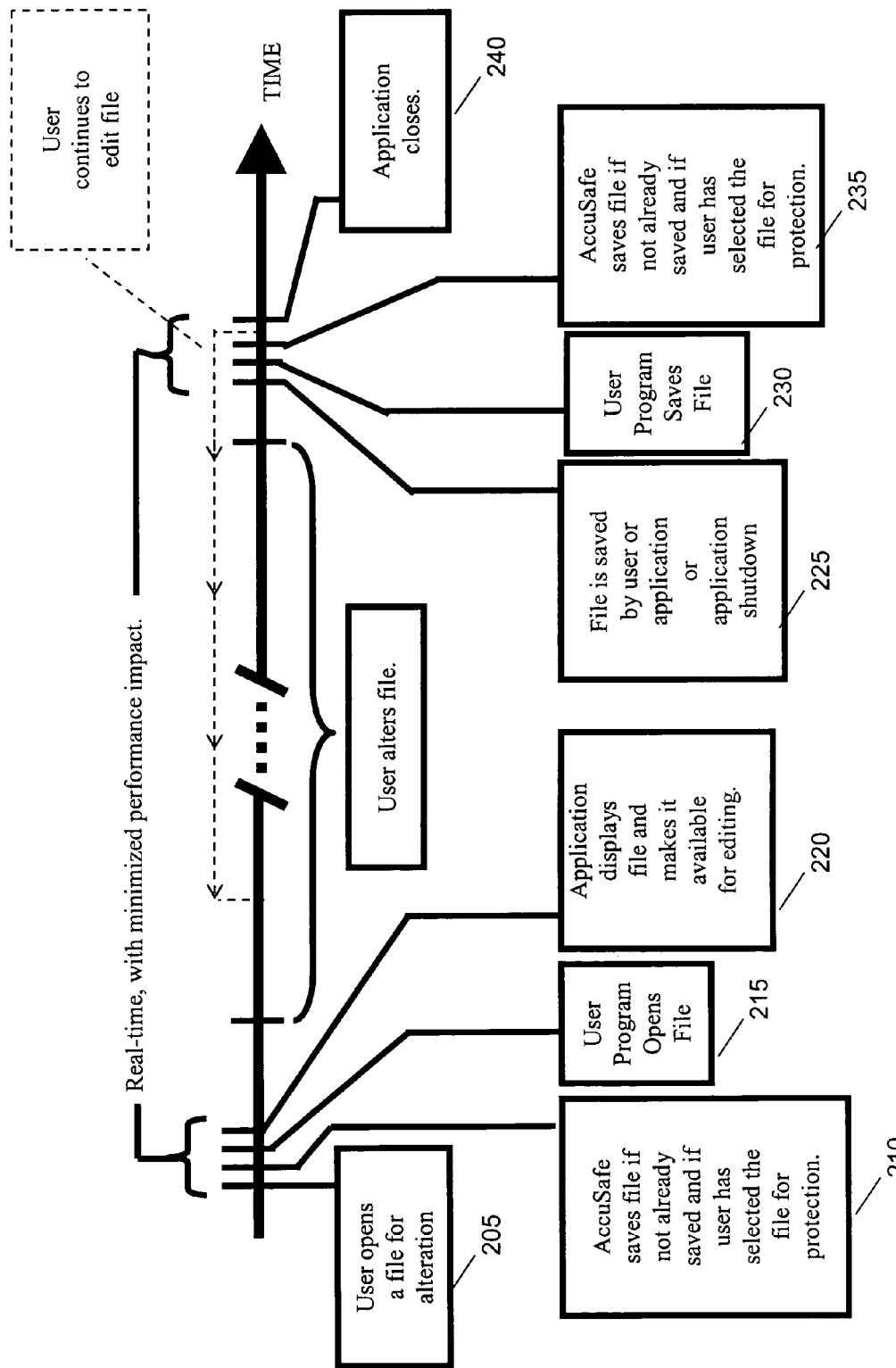


FIGURE 3

U.S. Patent

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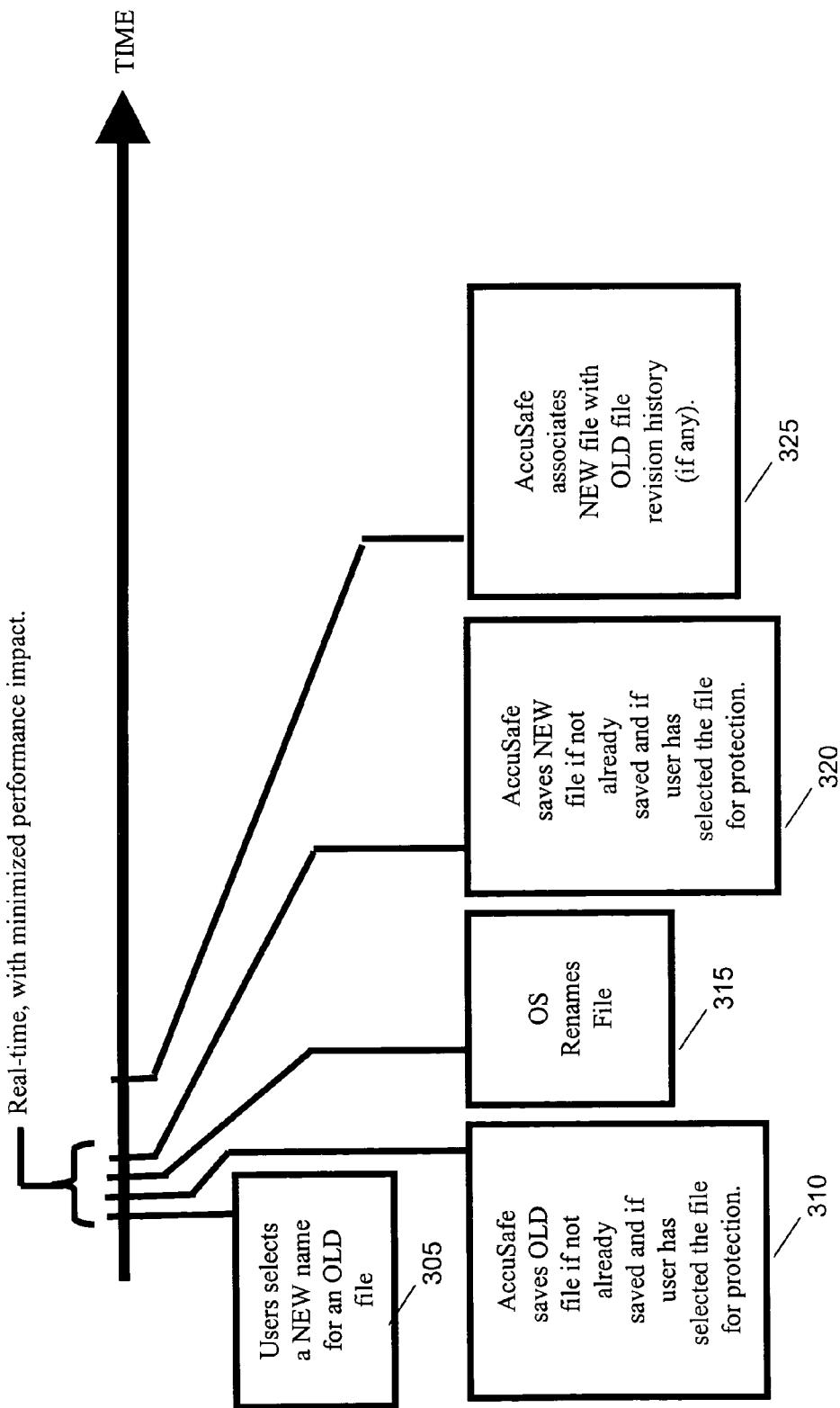


FIGURE 4

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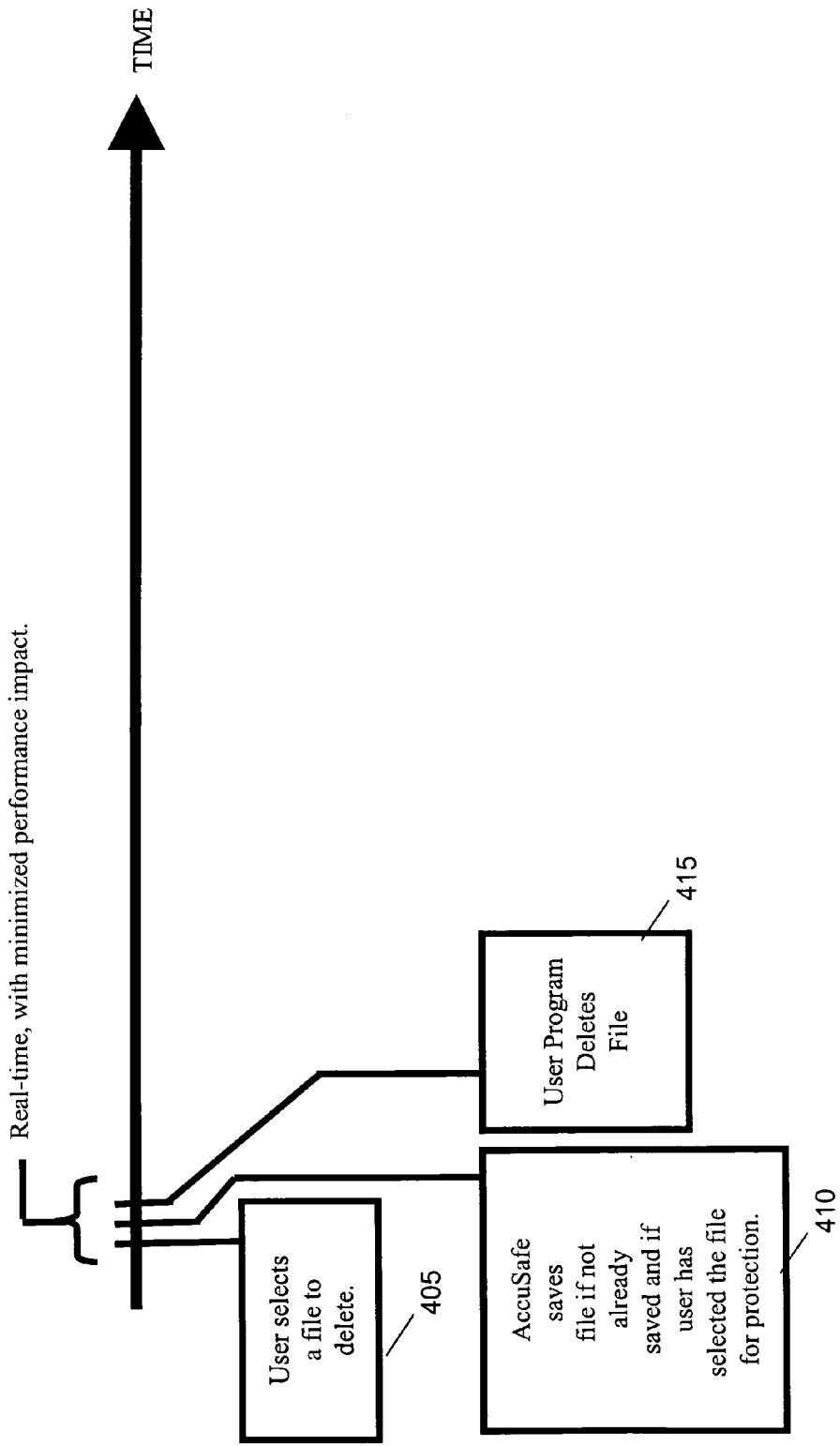


FIGURE 5

US 8,473,478 B2

1

AUTOMATIC REAL-TIME FILE MANAGEMENT METHOD AND APPARATUS

This application claims the benefit of Provisional Application No. 60/234,221 filed Sep. 21, 2000, which is herein incorporated by reference.

FIELD OF THE INVENTION

This invention relates to file preservation, file capture, file management and file integrity techniques for computing devices.

BACKGROUND OF THE INVENTION

One of the greatest challenges faced by information technology (IT) professionals and computer users today, particularly in the business environment is the protection and management of data. Data may be stored on user workstations, e.g., laptop computers, home or office desktop computers, network servers or other devices external to the workstations. Important data may even be stored on hand-held computing devices such as PDAs, PALS and other like devices. Complicating the problem is the fact that the criticality of data is increasing and the difficulty of managing it, protecting it from loss and keeping it available is increasing. This is due to a variety of factors, including: 1) the explosion in data volume, particularly that stored on desktop and laptop computers, 2) the increasing complexity of desktop and laptop computer software and hardware and increasing trends toward a paperless environment were absolute reliance (because paper copies are becoming less the norm) on data integrity is increasingly significant.

Many home computer users do not realize the vulnerability of their computer data. Many that do understand the very real potential for data loss, purchase backup systems whose operation and user interface is often confusing and/or time-consuming to use, dramatically decreasing their effectiveness or dependability. As a result, many computer users remain very much at risk of data loss resulting from hardware and/or software failures, fires, stolen equipment, etc. While these risks are significant, the most frequent cause of data loss is user error (accidental file deletes, file overwrites, errant programs, etc.), to which users remain very vulnerable even with most present day backup systems.

The financial impact of information loss is substantial. As reported by the Safeware Insurance Agency, in 1999 alone, insurance claims for damaged, lost and stolen computers (primarily notebook computers) totaled more than \$1.9 billion. This figure does not include the untold billions lost in intellectual capital and time. It is costly to recreate lost data and there are significant related costs such as lost productivity and lost opportunity. Consider, for example, the financial and health related impact of a doctor losing all patient contact information and medical histories due to a hard disk crash or some other type of computer failure. In addition, it is costly to keep desktop and laptop computers up and running in the wake of their increasing complexity.

A variety of products have been developed to address data preservation and integrity issues. These products may be loosely grouped into three categories, manual backup systems, schedule based backup systems and mirroring backup systems.

The least efficient and probably one of the most frequently used backup systems is the manual backup. At times determined by the user, the user selects files to be backed up and either utilizes the built in backup procedure for the corre-

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sponding application or manually copies the selected files to a desired backup storage media.

The problems with this method of preserving data are self-evident. Backup procedures are often confusing and may differ from application to application. Accordingly, the user must familiarize itself with the various methods for performing backups. In addition, users may forget to backup or elect not to do so on a given occasion due to time constraints or other reasons. Manual backups often do not allow the user to continue to use the system during the backup procedure. Furthermore, data stored to the backup media is really only a "snapshot" of the data at the time that the backup is performed. Any changes made between manual backups would be lost if there was a failure on the computer's storage device.

10 Schedule based backup systems typically perform backups according to a schedule either set by the user or preset by the backup software. One of the major disadvantages of each type of schedule-based backup system is that as with manual backups, they miss work done between schedule points. This may 15 cause the user to lose critical information as they work between schedule points. Another disadvantage of schedule-based backup systems is that they are frequently confusing and cumbersome for the user. Still another disadvantage of schedule-based backup systems is that they function poorly if 20 at all when the backup storage device is unavailable, i.e., they cannot be written to due to a communications error or because the device has reached its capacity, is bandwidth limited, or is 25 non-operational for some other reason.

30 Mirroring is a technique typically applied to disk based backup systems. Mirroring backup systems are the most comprehensive in that everything that happens to the source storage device immediately happens to the backup storage device. That is the backup drive becomes a mirror image of the source drive. Accordingly, if a failure occurs on the source 35 disk, processing can be switched to the backup disk with little or no service interruption.

30 The strongest advantage of mirroring systems is also their strongest disadvantage. Because there is no operational discrimination, if a file is accidentally deleted from the source 40 disk, it is deleted and cannot be preserved on the backup disk. Likewise, if a virus infects the source disk it is likely to infect the backup disk. Another disadvantage of mirroring systems is that separate backup disks are required for each source disk, doubling the disk requirement for the system. The backup 45 disk must be at least as large as the source disk and the disks must be configured with identical volume mapping. Any extra space that may be present on the backup disk is unavailable.

50 All of these methods require that the user specify which files/directories to back up, but many users have no concept of files and directories in their thought process, much less are they able to correlate a particular application (e.g. Microsoft 55 Excel) with the kinds and locations of files they generate. These systems simply require too much user knowledge, and too much user intervention. The backup user's risk increases dramatically the lower his computer knowledge may be.

In view of the foregoing, there is a need for a file capture, preservation and management system that captures files just before and/or just after they have been changed to minimize loss of data between backup events. There is also a need for 60 file capture and preservation system that captures files even when the destination storage medium for the files is unavailable. There is a further need for a system that allows users to recover easily and quickly from any type of information loss, including simple user errors, failed software installations or 65 updates, hardware failures (attached storage devices), and lost or stolen laptop computers. Users should be able to recover on their own, without the intervention of the IT staff,

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and their backup systems should be as "behind the scenes" as possible, requiring little user attention and extremely small amounts of user computer knowledge.

SUMMARY OF THE INVENTION

It is an object of the invention to a file capture, preservation and management method and apparatus that captures files just before and/or just after the files are changed.

It is another object of the invention to provide a file capture, preservation and management method and apparatus that has an imperceptible impact on system performance from the user's point of view.

It is a further object of the invention to provide a file capture, preservation and management method and apparatus that captures and stores files even when there is no connection to the desired storage location.

Still another object of the invention is to provide a file capture, preservation and management method and apparatus that captures and stores files even when the desired storage location is unavailable.

In accordance with an aspect of the invention, a method for archiving files is provided. The method includes, in a computing device, detecting an instruction from a resident program to perform an operation on an operating file. Upon detection of the instruction, capturing the operating file temporally proximate to the operation being performed on the operating file.

In accordance with another aspect of the invention, a method for moving files from a first storage location to a second storage location is provided. The method includes, in a computing device, searching a first storage location for files responsive to the occurrence of a first event and moving the files from the first storage location to the second storage location responsive to a second event.

In accordance with still another aspect of the invention, a method for archiving files is provided. The method includes detecting an instruction from a resident program to perform an operation on an operating file. The method further includes creating an archive file from the operating file and storing the archive file in a first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction. In keeping with the method, the first storage location is searched for an archive file responsive to the occurrence of a first event. The archive file is then moved from the first storage location to the second storage location responsive to a second event.

The accompanying figures show illustrative embodiments of the invention from which these and other of the objectives, novel features and advantages will be readily apparent.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a block diagram of a computing device in accordance with the present invention.

FIG. 2A is a flow chart depicting a process for moving files in accordance with the present invention.

FIG. 2B is a flow chart showing another process for moving files in accordance with the invention.

FIG. 3 is a time line illustrating a sequence of events in an exemplary operation in accordance with the invention.

FIG. 4 is a time line illustrating a sequence of events in another exemplary operation in accordance with the invention.

FIG. 5 is a time line illustrating a sequence of events in still another exemplary operation in accordance with the invention.

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DETAILED DESCRIPTION OF THE EMBODIMENT

Definitions

Operating System (OS)—A computer program that allocates system resources such as memory, disk space, and processor usage and makes it possible for the computer to boot up to a human user interface allowing the user to interact with the computer and control its operation.

Operating File—a system or user file.

Archive File—a file containing all of the data of an operating file in a native or altered format and/or a file containing at least some of the data of an operating file and including references to the location of the remainder of the data of the operating file.

Computing Device—a personal computer, a laptop or notebook computer, a server, a hand-held computing device, a PDA or a PAL. The term computing device is not specific to the kind of operating system being run on such computing device, and includes devices running Microsoft operating systems, Apple Macintosh operating systems, UNIX operating systems, Linux operating systems, and other operating systems.

Storage Location—any storage device, or a buffer, folder, directory or designated area on a storage device.

Personal Attached Storage Device—any internal or external storage device connected to a computing device.

Network Attached Storage Device—any storage device connected directly to a network to which a first computing device is also temporarily or permanently connected, or any storage device connected to a second computing device that is also temporarily or permanently connected to the network to which the first computing device is temporarily or permanently connected.

Internet storage area network—any storage area (device, collection of devices, etc.) that can be accessed by the computing device when the computing device is temporarily or permanently connected to the Internet.

Peer-to-Peer Storage Device—any storage area (device, collection of devices, etc.) that can be accessed by the computing device when it is sharing resources with other network or Internet accessible computers.

Resident Program—an operating system (OS) or other program that has control over file operations such as "read", "write", "save", "rename", "delete", "copy", "move", "open", "close", etc.

User Program—an application software program or other computing program installed by the user or by the computer manufacturer for user creation of desired data, documents, or other information that is designed to enhance the functionality and/or enjoyment and/or usability of the computing device. The present invention is directed to an apparatus and/or method for file capture, preservation and management.

The invention includes a file capture aspect and smart data management aspect. The invention may be realized as a method and/or an apparatus. More particularly, the invention may be realized as a set of program code instructions stored on a computer usable medium, a set of program code instructions embodied in a signal for transmitting computer information, and a processor and/or computing device configured as described herein.

FIG. 1 depicts a block diagram in accordance with the present invention comprising a computing device 5 including a file capture block 10 (or file capturer), a smart data management block 15 (or smart data manager), an input buffer 20, output buffer(s) 25, and a database 30. A storage device 35 is

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also provided and may be either internal or external to computing device 5. The invention functions in conjunction with a resident program on computing device 5.

In accordance with an embodiment of the invention, file capture block 10 detects an instruction to perform an operation on an operating file initiated by the resident program of computing device 5. At a moment temporally proximate to when the resident program actually performs the operation, i.e., just before and/or just after the operation is performed on the operating file, or, more preferably, the instant before and/or the instant after the operating file is changed, file capture block 10 captures the operating file or portions thereof. Preferably, the operating file is captured within a few clock cycles of the detection of the instruction.

In keeping with a preferred aspect of the invention, file capture block 10 causes the location of the captured operating file to be recorded in database 30. The continued process of recording information about captured operating files, or portions thereof, in database 30 creates a record of each version of the operating file, which may be accessed by the user or by other programs.

File capture is preferably executed by creating an archive file from the operating file. The archive file is preferably stored in a temporary storage location, internal or external to the computer, such as input buffer 20. However, the archive file may be stored directly in storage device 35. In accordance with a preferred aspect of the invention, storage device 35 may be a personal attached storage device, a network attached storage device, an Internet storage area network, a peer-to-peer storage device, or other storage device.

In keeping with a preferred aspect of the invention, smart data management block 15 manages the migration of the archive file from the input buffer 20 through the output buffers 25 to storage device 35. This migration may take place either synchronously or asynchronously with the file capture procedures described herein. The time duration from a file arriving in input buffer 20 and when it arrives on archive storage device 35 is managed by the smart data management block 15. More particularly smart data management block 15 regularly examines input buffer 20 for the presence of archive files. Smart data management block 15 performs this examination upon the occurrence of an event, e.g., messages from the file capture block 10 and/or various messages from the resident program(s), messages from an input buffer timer sent at time intervals controlled by a timer or at time intervals selected by the user. Optionally, smart data management block 15 may then examine database 30 to determine a defined storage location for each of the archive files stored in input buffer 20. Each archive file stored in the input buffer 20 may be directed to the same storage location or to different storage locations and archive files may be directed to multiple storage locations for redundancy. Preferably, smart data management block 15 moves the archive files to one or more output buffers 25. More preferably each archive file is moved to output buffer(s) 25 corresponding to the final storage location(s) for that archive file. Alternatively, all archive files may be moved to a single common output buffer 25 if desired. Upon the occurrence of an event, and/or at defined time intervals, smart data management block 15 moves the archive files from the output buffers 25 to their respective storage device(s) 35. Exemplary events include but are not limited to messages indicating when storage device 35 is connected and ready for use, messages indicating when storage device 35 is inserted/removed, full, defective, etc., and messages indicating when storage device 35 is disconnected or unavailable, and messages from a storage device timer sent at time intervals controlled by the timer or at time intervals controlled by

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the user. The input buffer timer and the storage device timer may operate synchronously or non-synchronously.

Under certain conditions, smart data management block 15 may be unable, or may elect not to move the archive files. For example, if storage device 35 is unavailable then smart data management block 15 will not move the archive files to storage device 35. Among the conditions that may cause storage device 35 to be unavailable are i) storage device 35 is disconnected from computing device 5, ii) the connection between storage device 35 and computing device 5 is faulty or unacceptably slow, iii) storage device 35 is full, or iv) storage device 35 is malfunctioning. In addition, smart data management block 15 may also regulate movement of archive files according to time schedules set by the user, by monitoring connection bandwidth availability and moving files only during times of high bandwidth availability, or by monitoring other factors including messages that may received from storage location server requests for archive file transmittal.

A preferred operational mode for smart data management block 15 is illustrated in the flowcharts of FIGS. 2A and 2B. In step 100 of FIG. 2A, smart data manager 15 examines input buffer 20 to determine whether any archive files are stored therein. If no archive files are present, smart data manager 15 rests idle until the next event occurs. If archive files are detected, in step 105, smart data manager 15 updates database 25 to indicate the location of the archive files; that is, to indicate that the archive files are resident in input buffer 20. In step 110, smart data manager 15 examines database 30 to determine the proper destination for each archive file. In step 115, smart data manager 15 moves the archive files to output buffers 25. In step 120, smart data manager 15 updates database 30 to indicate that the archive files are now stored in the output buffer.

In FIG. 2B in step 125, the archive files are moved to one or more storage devices 30. If smart data manager 15 is unable to move the archive files to any of the storage devices 30, smart data manager 15 rests idle and does not move the archive files until it is notified that the storage device is available. Accordingly, the archive files remain in either input buffer 20 or output buffer 25 until smart data management block 15 is notified. In step 130 smart data manager 15 updates database 25 to indicate that the archive files are stored in one or more storage devices 30.

Use Specific to User Program Operations

The following examples are directed to embodiments of the invention specific to operations performed by a user program. The file capture, preservation and management processes of the invention are not limited to execution with the exemplary operation discussed below. The processes of the invention are preferably executed when a resident program causes a change or a change to be imminent in the operating file. Therefore, the following examples are intended to be exemplary only and nonlimiting.

File Capture at File Open

As illustrated in FIG. 3, in step 205, the user or a program selects an "open" operation to open an operating file and an instruction to perform that "open" operation on the operating file is sent to the resident program. In step 210, file capture block 10 detects the instruction and captures the operating file. Optionally, prior to capturing the operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 creates an archive file and stores the archive file in a storage location such as input buffer 20 or storage device 35 just before the

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resident program opens the operating file. Preferably, file capture block 10 stores the archive file in input buffer 20. In step 215 the resident program opens the operating file and in step 220 the user program displays the operating file as originally requested, e.g. Microsoft Word, and makes it available for the user to alter, e.g., edit a word processing document, amend or add to a database, etc. Step 210 is performed by momentarily delaying the execution of step 215 in such a manner as to have little or no perceptible impact on system performance from the user's point of view.

In step 225, the user program begins a process to save the altered operating file and an instruction to save the altered operating file is sent to the resident program. In step 230 the resident program saves the altered operating file pursuant to the instruction. In step 235, immediately after the altered operating file is saved by the resident program, file capture block 10 captures the altered operating file, preferably by creating and storing an archive file of the altered operating file in input buffer 20. In accordance with a preferred feature of the invention, file capture block 10 may save the archive file in such a way that previous revisions of the operating file are retained. That is, every time the operating file is changed, file capture block 10 saves an archive file and database 30 is updated with information about the archive file. Accordingly, over time, a plurality of archive files may be created from the original operating file. Each archive file represents a revision of the original operating file.

File Capture in the "RENAME" Operation

As illustrated in FIG. 4, step 305, in performing an operating file rename operation, the user or a program generates an instruction for the resident program to select a new name for an old operating file. In step 310, file capture block 10 detects the instruction and captures the old operating file. Optionally, prior to capturing the old operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 creates an archive file of the old operating file and stores the archive file in a storage location such as storage device 35 or, more preferably, input buffer 20 just before the resident program renames the old operating file. In step 315 the resident program renames the old operating file, thus creating a new operating file. Immediately after the old operating file is renamed, file capture block 10 captures the new operating file. Optionally, prior to capturing the new operating file, file capture block 10 may determine whether the new operating file has previously been archived, whether the user has selected the new operating file for protection, or other matching conditions exist. Like the archive file for the old operating file, the archive file for the new operating file is preferably stored in input buffer 20. In step 325 file capture block 10 and smart data management block 15 associate or link the new operating file with each of the versions of the old operating file to create a continuous operating file revision history.

File Capture in the "Delete" Operation

FIG. 5 illustrates the file capture process in the delete operation. In step 405, the user or a program identifies an operating file to delete and generates an instruction to the resident program. In step 410, file capture block 10 detects the instruction and captures the operating file just before it is deleted in step 415. Optionally, prior to capturing the operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other

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defined conditions. If the go-ahead conditions exist, then file capture block 10 preferably captures the operating file. In step 420, the resident program deletes the operating file.

As shown by the examples given, a clear advantage of the invention is, regardless of the operation being performed, after each file capture step, file capture block 10 preferably updates database 30 to indicate the location of the corresponding archive file. Database 30 may keep track of multiple versions of an operating file, any of which may be accessed at the request of the user or other program.

Another advantage of the invention is that by capturing the operating file just before and/or just after an operation is performed thereon, the invention achieves near real-time operating file archiving while achieving minimal missed alterations to an operating file.

A further advantage of the invention in its preferred embodiment, is that by intelligently managing the migration of operating files from the input buffer 20 through the output buffer 25 to the storage device 35, the invention achieves protection of operating files even when the desired storage device is permanently or temporarily unavailable.

INDUSTRIAL APPLICABILITY

The present invention is suited for any application that requires or benefits from near real time file capture, that seeks improved file integrity and/or that seeks efficient management of file storage. For example, the present invention is particularly useful in backup systems, audit trail systems, computer security systems, systems for monitoring computer users and others.

Although the present invention has been described in terms of particular preferred embodiments, it is not limited to those embodiments. Alternative embodiments, examples, and modifications which would still be encompassed by the invention may be made by those skilled in the art, particularly in light of the foregoing teachings.

We claim:

1. In a computing device, a method for archiving files comprising:
 - detecting an instruction by an operating system to perform an operation on an operating file;
 - creating an archive file from the operating file and storing the archive file in a temporary first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
 - searching the first temporary storage location for the archive file responsive to the occurrence of a first event; and
 - moving the archive file to a second storage location responsive to a second event, the second storage location being a permanent storage location,
 - after storing the archive file in the first temporary storage location, updating a database to indicate that the archive file is located in the first temporary storage location;
 - determining a final destination for the archive file;
 - moving the archive file from the first temporary storage location to an intermediate storage location;
 - updating the database to indicate that the archive file is located in the intermediate storage location; and
 - after moving the archive file to the second storage location, updating the database to indicate that the archive file is located in the second storage location.
2. The method of claim 1 wherein the second storage location includes a personal attached storage device.

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3. The method of claim 1 wherein the second storage location includes a network attached storage device.

4. The method of claim 1 wherein the second storage location includes a peer-to-peer storage device.

5. The method of claim 1 wherein the second storage location includes an Internet storage area network.

6. An article of manufacture comprising a non-transitory computer usable medium having computer readable program code for performing the method of claim 1.

7. An article of manufacture comprising a processor configured to perform the method of claim 1.

8. In a computing device, a method for archiving files comprising:

detecting an instruction by an operating system to perform an operation on an operating file;

creating an archive file from the operating file and storing the archive file in a temporary first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;

searching the first temporary storage location for the archive file responsive to the occurrence of a first event; and

moving the archive file to a second storage location responsive to a second event, the second storage location being a permanent storage location,

wherein the first event includes a message from a timer.

9. In a computing device, a method for archiving files comprising:

detecting an instruction by an operating system to perform an operation on an operating file;

creating an archive file from the operating file and storing the archive file in a temporary first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;

searching the first temporary storage location for the archive file responsive to the occurrence of a first event; and

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moving the archive file to a second storage location responsive to a second event, the second storage location being a permanent storage location.

wherein the second event includes a message from a timer.

10. In a computing device, a method for archiving files comprising:

detecting an instruction by an operating system to perform an operation on an operating file;

creating an archive file from the operating file and storing the archive file in a temporary first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;

searching the first temporary storage location for the archive file responsive to the occurrence of a first event; and

moving the archive file to a second storage location responsive to a second event, the second storage location being a permanent storage location,

wherein the second event includes a message indicating when the second storage location is available.

11. In a computing device, a method for archiving files comprising:

detecting an instruction by an operating system to perform an operation on an operating file;

creating an archive file from the operating file and storing the archive file in a temporary first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;

searching the first temporary storage location for the archive file responsive to the occurrence of a first event; and

moving the archive file to a second storage location responsive to a second event, the second storage location being a permanent storage location,

wherein said first event is different from said second event.

* * * * *

EXHIBIT B



US009218348B2

(12) **United States Patent**
Roach et al.

(10) **Patent No.:** **US 9,218,348 B2**
(45) **Date of Patent:** ***Dec. 22, 2015**

(54) **AUTOMATIC REAL-TIME FILE
MANAGEMENT METHOD AND APPARATUS**

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This patent is subject to a terminal disclaimer.

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(52) **U.S. Cl.**

CPC **G06F 17/30073** (2013.01); **G06F 11/1461** (2013.01); **G06F 17/30067** (2013.01)

(58) **Field of Classification Search**

CPC G06F 17/30073

USPC 707/672
See application file for complete search history.

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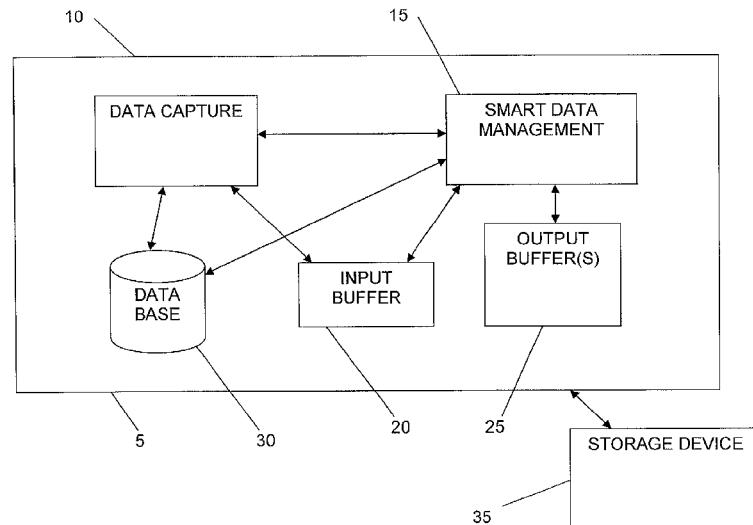
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(57) **ABSTRACT**

A method for archiving files includes determining when a change in an operating file is imminent, capturing the operating file immediately before the change in the operating file occurs, if the operating file has not already been captured; and capturing the operating file immediately after the change in the operating file has occurred.

31 Claims, 6 Drawing Sheets



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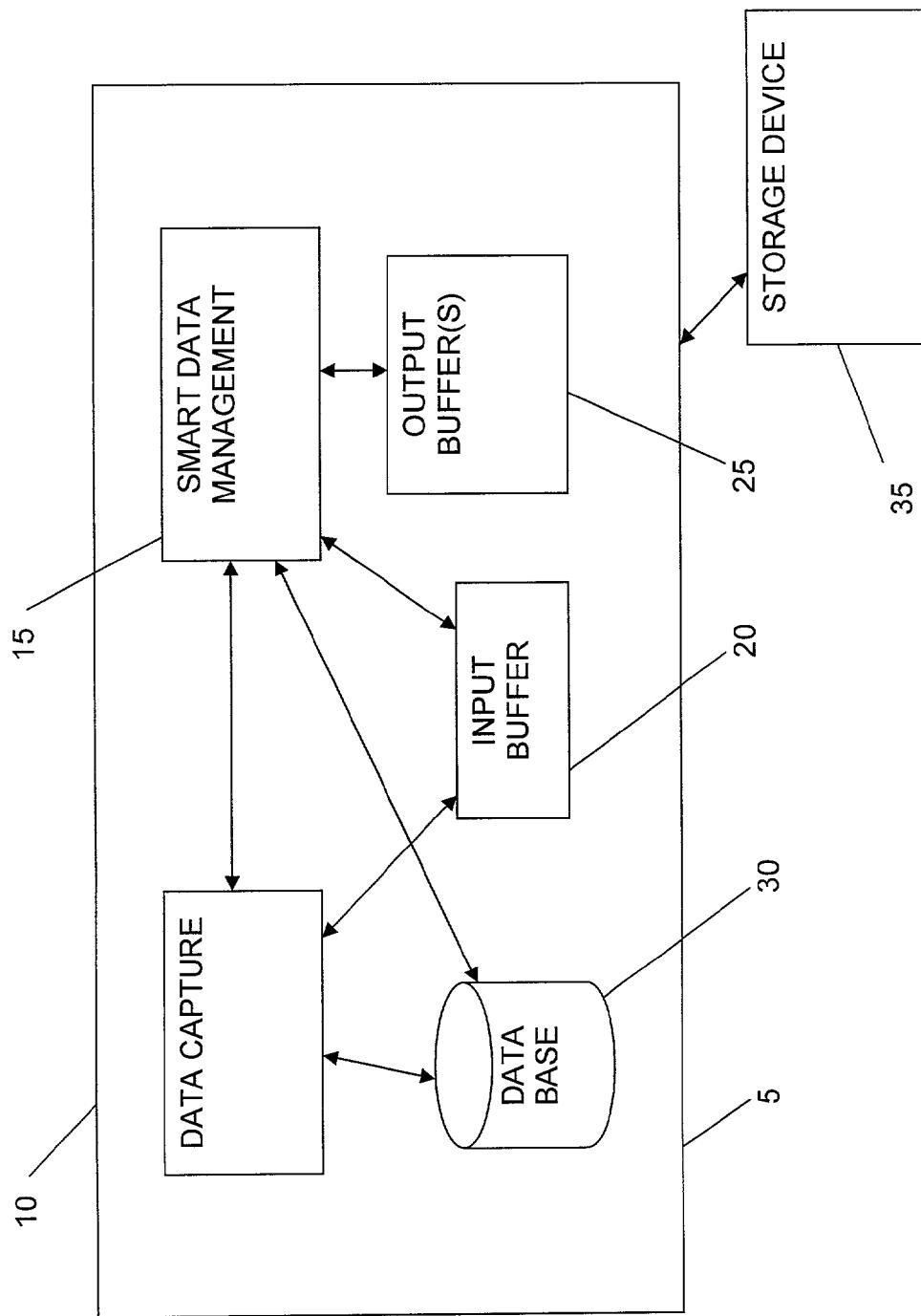


FIGURE 1

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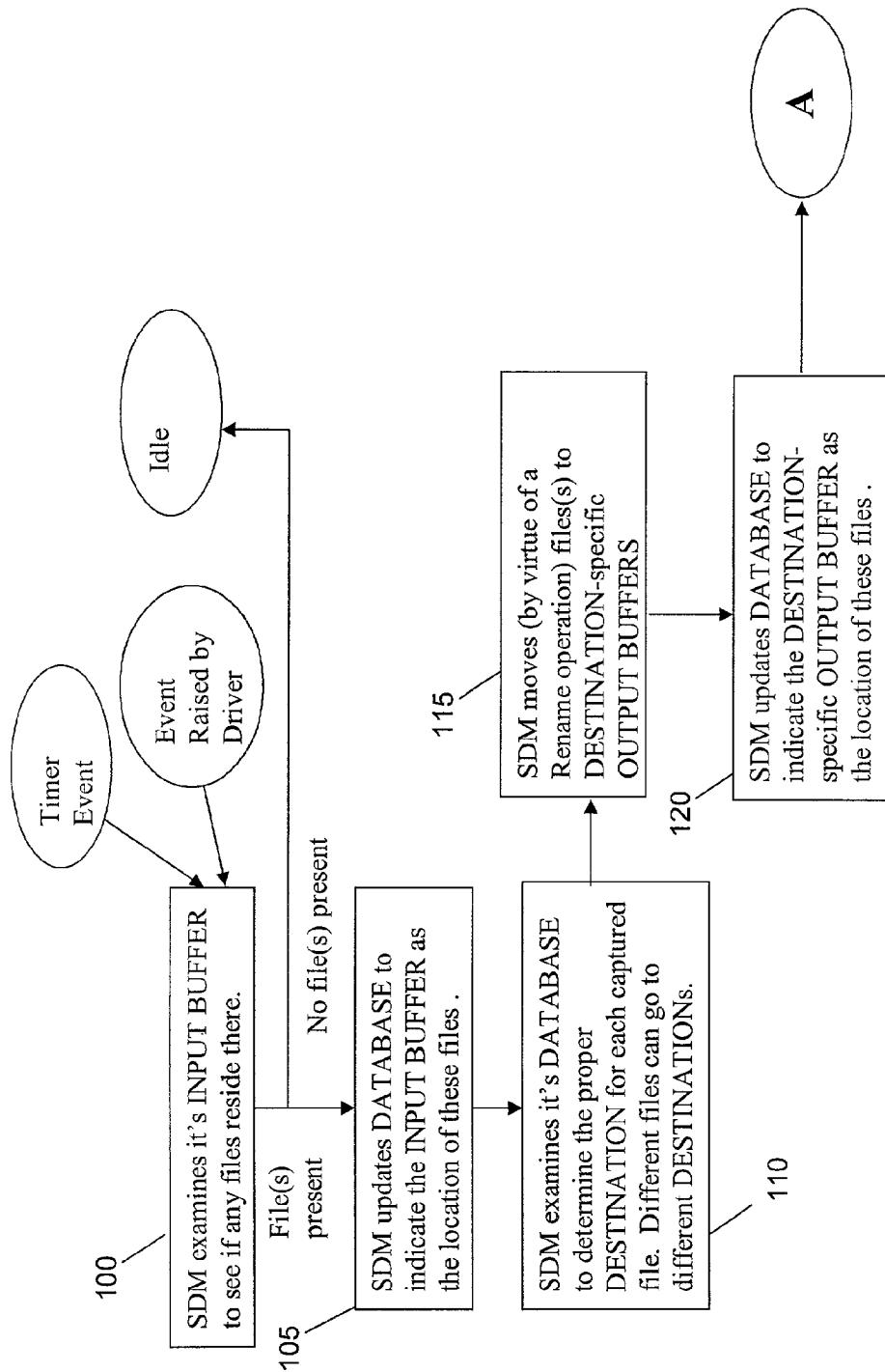


FIGURE 2A

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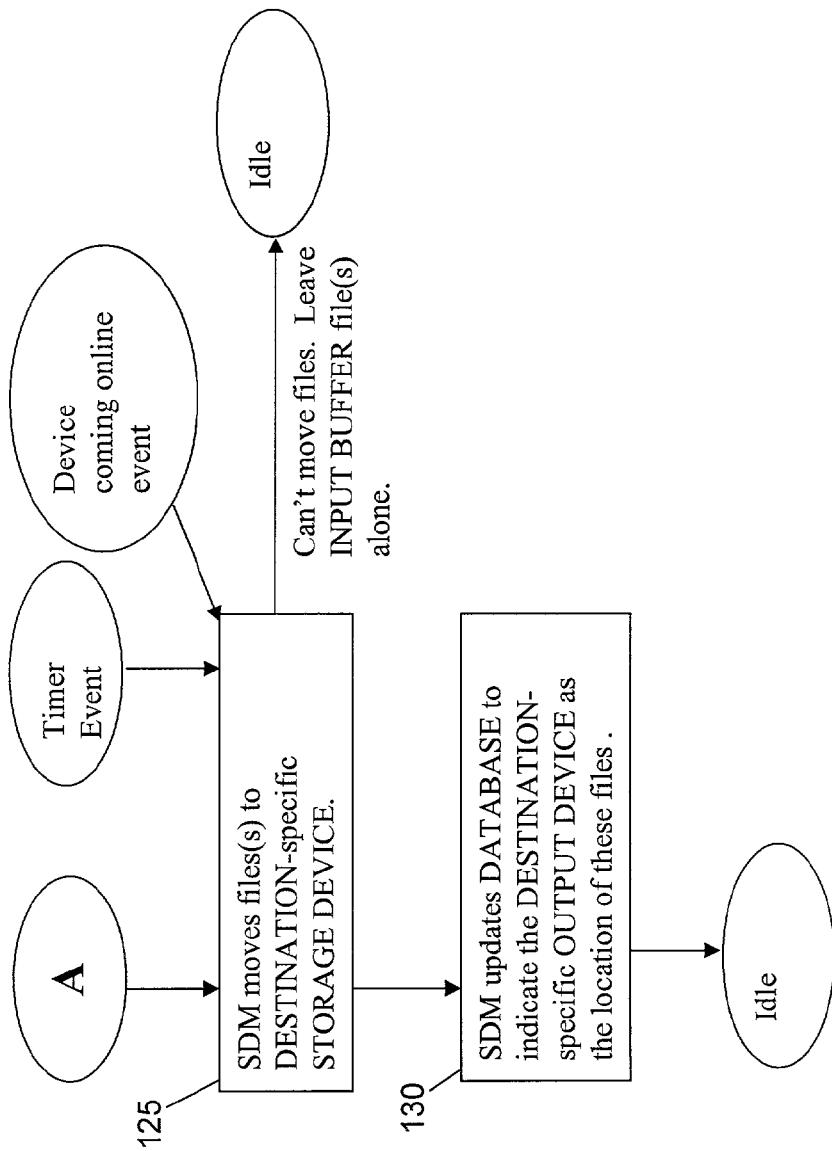


FIGURE 2B

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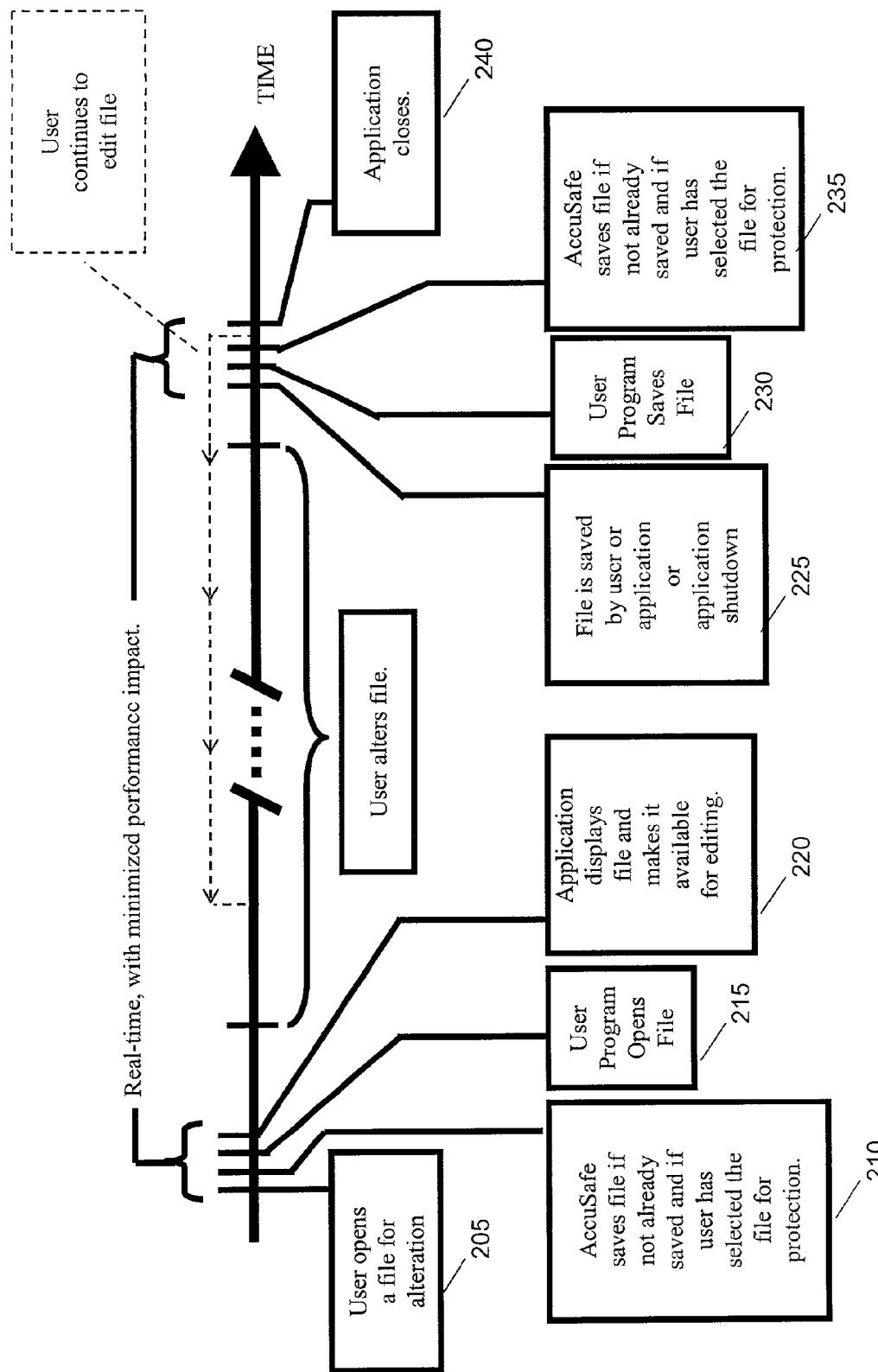


FIGURE 3

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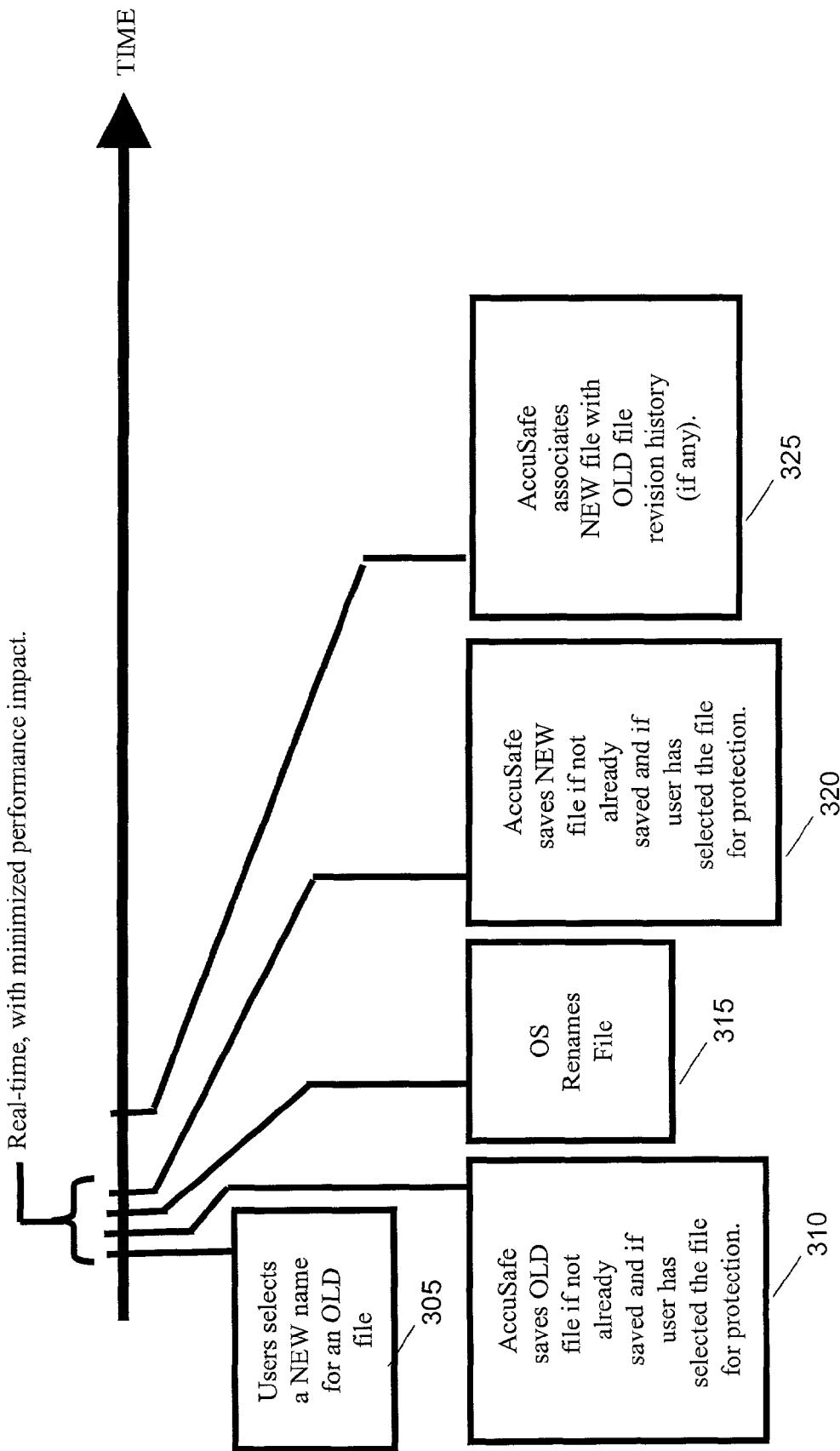


FIGURE 4

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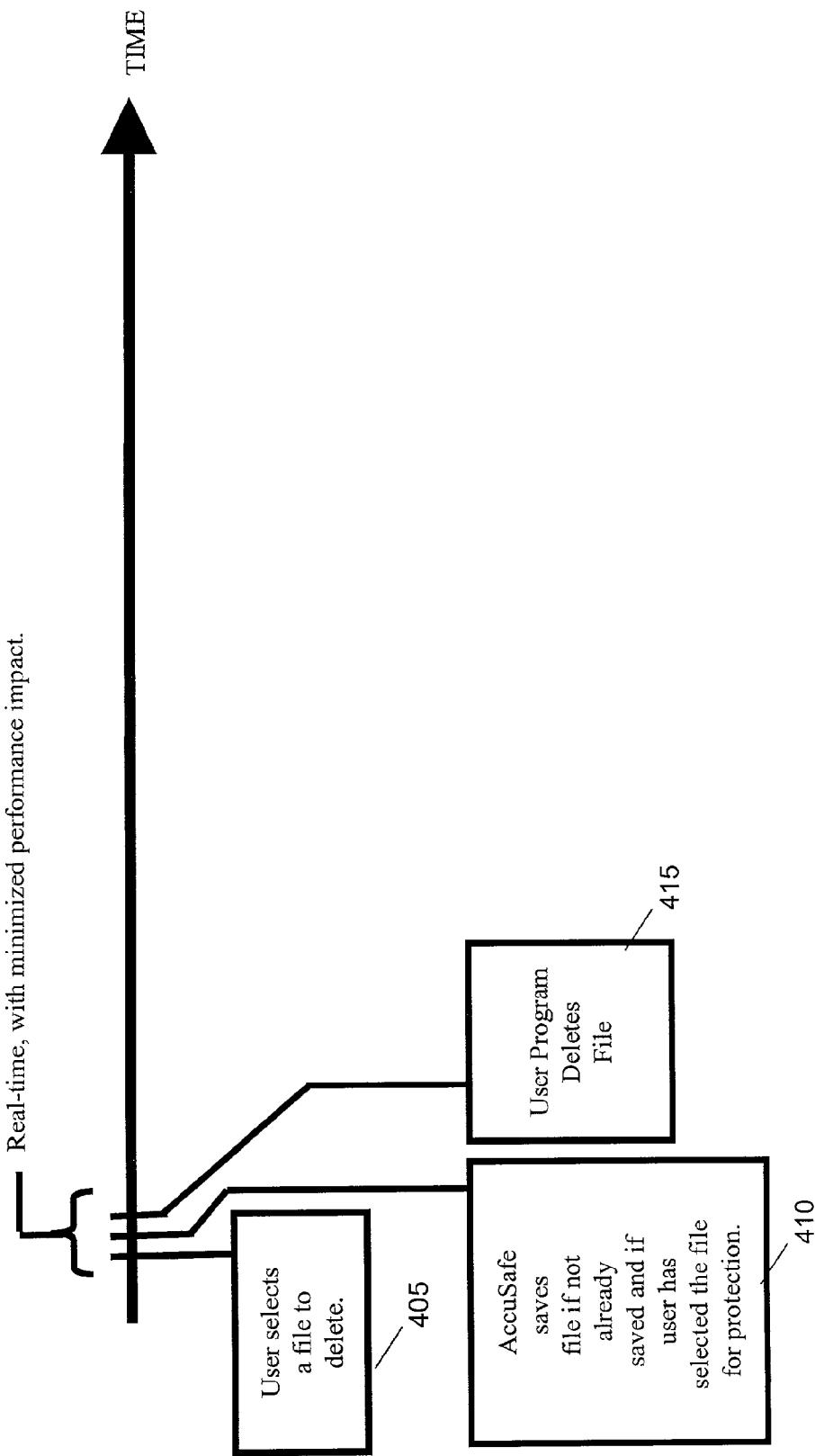


FIGURE 5

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AUTOMATIC REAL-TIME FILE MANAGEMENT METHOD AND APPARATUS

This application is a continuation of U.S. patent application Ser. No. 09/957,459 filed Sep. 21, 2001, which claims the benefit of U.S. Provisional Application No. 60/234,221 filed Sep. 21, 2000, each of which is herein incorporated by reference.

FIELD OF THE INVENTION

This invention relates to file preservation, file capture, file management and file integrity techniques for computing devices.

BACKGROUND OF THE INVENTION

One of the greatest challenges faced by information technology (IT) professionals and computer users today, particularly in the business environment is the protection and management of data. Data may be stored on user workstations, e.g., laptop computers, home or office desktop computers, network servers or other devices external to the workstations. Important data may even be stored on hand-held computing devices such as PDAs, PALS and other like devices. Complicating the problem is the fact that the criticality of data is increasing and the difficulty of managing it, protecting it from loss and keeping it available is increasing. This is due to a variety of factors, including: 1) the explosion in data volume, particularly that stored on desktop and laptop computers, 2) the increasing complexity of desktop and laptop computer software and hardware and increasing trends toward a paperless environment were absolute reliance (because paper copies are becoming less the norm) on data integrity is increasingly significant.

Many home computer users do not realize the vulnerability of their computer data. Many that do understand the very real potential for data loss, purchase backup systems whose operation and user interface is often confusing and/or time-consuming to use, dramatically decreasing their effectiveness or dependability. As a result, many computer users remain very much at risk of data loss resulting from hardware and/or software failures, fires, stolen equipment, etc. While these risks are significant, the most frequent cause of data loss is user error (accidental file deletes, file overwrites, errant programs, etc.), to which users remain very vulnerable even with most present day backup systems.

The financial impact of information loss is substantial. As reported by the Safeware Insurance Agency, in 1999 alone, insurance claims for damaged, lost and stolen computers (primarily notebook computers) totaled more than \$1.9 billion. This figure does not include the untold billions lost in intellectual capital and time. It is costly to recreate lost data and there are significant related costs such as lost productivity and lost opportunity. Consider, for example, the financial and health related impact of a doctor losing all patient contact information and medical histories due to a hard disk crash or some other type of computer failure. In addition, it is costly to keep desktop and laptop computers up and running in the wake of their increasing complexity.

A variety of products have been developed to address data preservation and integrity issues. These products may be loosely grouped into three categories, manual backup systems, schedule based backup systems and mirroring backup systems.

The least efficient and probably one of the most frequently used backup systems is the manual backup. At times deter-

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mined by the user, the user selects files to be backed up and either utilizes the built in backup procedure for the corresponding application or manually copies the selected files to a desired backup storage media.

5 The problems with this method of preserving data are self-evident. Backup procedures are often confusing and may differ from application to application. Accordingly, the user must familiarize itself with the various methods for performing backups. In addition, users may forget to backup or elect not to on a given occasion due to time constraints or other reasons. Manual backups often do not allow the user to continue to use the system during the backup procedure. Furthermore, data stored to the backup media is really only a "snapshot" of the data at the time that the backup is performed. Any 10 changes made between manual backups would be lost if there was a failure on the computer's storage device.

Schedule based backup systems typically perform backups according to a schedule either set by the user or preset by the backup software. One of the major disadvantages of each type 20 of schedule-based backup system is that as with manual backups, they miss work done between schedule points. This may cause the user to loose critical information as they work between schedule points. Another disadvantage of schedule-based backups systems is that they are frequently confusing and cumbersome for the user. Still another disadvantage of schedule-based backup systems is that they function poorly if at all when the backup storage device is unavailable, i.e., they cannot be written to due to a communications error or because the device has reached its capacity, is bandwidth limited, or is 25 non-operational for some other reason.

Mirroring is a technique typically applied to disk based backup systems. Mirroring backup systems are the most comprehensive in that everything that happens to the source storage device immediately happens to the backup storage 30 device. That is the backup drive becomes a mirror image of the source drive. Accordingly, if a failure occurs on the source disk, processing can be switched to the backup disk with little or no service interruption.

The strongest advantage of mirroring systems is also their 35 strongest disadvantage. Because there is no operational discrimination, if a file is accidentally deleted from the source disk, it is deleted and cannot be preserved on the backup disk. Likewise, if a virus infects the source disk it is likely to infect the backup disk. Another disadvantage of mirroring systems 45 is that separate backup disks are required for each source disk, doubling the disk requirement for the system. The backup disk must be at least as large as the source disk and the disks must be configured with identical volume mapping. Any extra space that may be present on the backup disk is unavailable.

All of these methods require that the user specify which 50 files/directories to back up, but many users have no concept of files and directories in their thought process, much less are they able to correlate a particular application (e.g. Microsoft Excel) with the kinds and locations of files they generate.

55 These systems simply require too much user knowledge, and too much user intervention. The backup user's risk increases dramatically the lower his computer knowledge may be.

In view of the foregoing, there is a need for a file capture, preservation and management system that captures files just 60 before and/or just after they have been changed to minimize loss of data between backup events. There is also a need for file capture and preservation system that captures files even when the destination storage medium for the files is unavailable. There is a further need for a system that allows users to 65 recover easily and quickly from any type of information loss, including simple user errors, failed software installations or updates, hardware failures (attached storage devices), and

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lost or stolen laptop computers. Users should be able to recover on their own, without the intervention of the IT staff, and their backup systems should be as “behind the scenes” as possible, requiring little user attention and extremely small amounts of user computer knowledge.

SUMMARY OF THE INVENTION

It is an object of the invention to a file capture, preservation and management method and apparatus that captures files just before and/or just after the files are changed.

It is another object of the invention to provide a file capture, preservation and management method and apparatus that has an imperceptible impact on system performance from the user's point of view.

It is a further object of the invention to provide a file capture, preservation and management method and apparatus that captures and stores files even when there is no connection to the desired storage location.

Still another object of the invention is to provide a file capture, preservation and management method and apparatus that captures and stores files even when the desired storage location is unavailable.

In accordance with an aspect of the invention, a method for archiving files is provided. The method includes, in a computing device, detecting an instruction from a resident program to perform an operation on an operating file. Upon detection of the instruction, capturing the operating file temporally proximate to the operation being performed on the operating file.

In accordance with another aspect of the invention, a method for moving files from a first storage location to a second storage location is provided. The method includes, in a computing device, searching a first storage location for files responsive to the occurrence of a first event and moving the files from the first storage location to the second storage location responsive to a second event.

In accordance with still another aspect of the invention, a method for archiving files is provided. The method includes detecting an instruction from a resident program to perform an operation on an operating file. The method further includes creating an archive file from the operating file and storing the archive file in a first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction. In keeping with the method, the first storage location is searched for an archive file responsive to the occurrence of a first event. The archive file is then moved from the first storage location to the second storage location responsive to a second event.

The accompanying figures show illustrative embodiments of the invention from which these and other of the objectives, novel features and advantages will be readily apparent.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a block diagram of a computing device in accordance with the present invention.

FIG. 2A is a flow chart depicting a process for moving files in accordance with the present invention.

FIG. 2B is a flow chart showing another process for moving files in accordance with the invention.

FIG. 3 is a time line illustrating a sequence of events in an exemplary operation in accordance with the invention.

FIG. 4 is a time line illustrating a sequence of events in another exemplary operation in accordance with the invention.

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FIG. 5 is a time line illustrating a sequence of events in still another exemplary operation in accordance with the invention.

5 DETAILED DESCRIPTION OF THE EMBODIMENT

Definitions

10 Operating System (OS)—A computer program that allocates system resources such as memory, disk space, and processor usage and makes it possible for the computer to boot up to a human user interface allowing the user to interact with the computer and control its operation.

15 Operating File—a system or user file.

Archive File—a file containing all of the data of an operating file in a native or altered format and/or a file containing at least some of the data of an operating file and including 20 references to the location of the remainder of the data of the operating file.

Computing Device—a personal computer, a laptop or notebook computer, a server, a hand-held computing device, a PDA or a PAL. The term computing device is not specific to 25 the kind of operating system being run on such computing device, and includes devices running Microsoft operating systems, Apple Macintosh operating systems, UNIX operating systems, Linux operating systems, and other operating systems.

30 Storage Location—any storage device, or a buffer, folder, directory or designated area on a storage device.

Personal Attached Storage Device—any internal or external storage device connected to a computing device.

Network Attached Storage Device—any storage device 35 connected directly to a network to which a first computing device is also temporarily or permanently connected, or any storage device connected to a second computing device that is also temporarily or permanently connected to the network to which the first computing device is temporarily or permanently connected.

Internet storage area network—any storage area (device, collection of devices, etc.) that can be accessed by the computing device when the computing device is temporarily or permanently connected to the Internet.

40 Peer-to-Peer Storage Device—any storage area (device, collection of devices, etc.) that can be accessed by the computing device when it is sharing resources with other network or Internet accessible computers.

Resident Program—an operating system (OS) or other program 50 that has control over file operations such as “read”, “write”, “save”, “rename”, “delete”, “copy”, “move”, “open”, “close”, etc.

User Program—an application software program or other computing program installed by the user or by the computer 55 manufacturer for user creation of desired data, documents, or other information that is designed to enhance the functionality and/or enjoyment and/or usability of the computing device. The present invention is directed to an apparatus and/or method for file capture, preservation and management.

60 The invention includes a file capture aspect and smart data management aspect. The invention may be realized as a method and/or an apparatus. More particularly, the invention may be realized as a set of program code instructions stored on a computer usable medium, a set of program code instructions embodied in a signal for transmitting computer information, and a processor and/or computing device configured as described herein.

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FIG. 1 depicts a block diagram in accordance with the present invention comprising a computing device 5 including a file capture block 10 (or file capturer), a smart data management block 15 (or smart data manager), an input buffer 20, output buffer(s) 25, and a database 30. A storage device 35 is also provided and may be either internal or external to computing device 5. The invention functions in conjunction with a resident program on computing device 5.

In accordance with an embodiment of the invention, file capture block 10 detects an instruction to perform an operation on an operating file initiated by the resident program of computing device 5. At a moment temporally proximate to when the resident program actually performs the operation, i.e., just before and/or just after the operation is performed on the operating file, or, more preferably, the instant before and/or the instant after the operating file is changed, file capture block 10 captures the operating file or portions thereof. Preferably, the operating file is captured within a few clock cycles of the detection of the instruction.

In keeping with a preferred aspect of the invention, file capture block 10 causes the location of the captured operating file to be recorded in database 30. The continued process of recording information about captured operating files, or portions thereof, in database 30 creates a record of each version of the operating file, which may be accessed by the user or by other programs.

File capture is preferably executed by creating an archive file from the operating file. The archive file is preferably stored in a temporary storage location, internal or external to the computer, such as input buffer 20. However, the archive file may be stored directly in storage device 35. In accordance with a preferred aspect of the invention, storage device 35 may be a personal attached storage device, a network attached storage device, an Internet storage area network, a peer-to-peer storage device, or other storage device.

In keeping with a preferred aspect of the invention, smart data management block 15 manages the migration of the archive file from the input buffer 20 through the output buffers 25 to storage device 35. This migration may take place either synchronously or asynchronously with the file capture procedures described herein. The time duration from a file arriving in input buffer 20 and when it arrives on archive storage device 35 is managed by the smart data management block 15. More particularly smart data management block 15 regularly examines input buffer 20 for the presence of archive files. Smart data management block 15 performs this examination upon the occurrence of an event, e.g., messages from the file capture block 10 and/or various messages from the resident program(s), messages from an input buffer timer sent at time intervals controlled by a timer or at time intervals selected by the user. Optionally, smart data management block 15 may then examine database 30 to determine a defined storage location for each of the archive files stored in input buffer 20. Each archive file stored in the input buffer 20 may be directed to the same storage location or to different storage locations and archive files may be directed to multiple storage locations for redundancy. Preferably, smart data management block 15 moves the archive files to one or more output buffers 25. More preferably each archive file is moved to output buffer(s) 25 corresponding to the final storage location(s) for that archive file. Alternatively, all archive files may be moved to a single common output buffer 25 if desired. Upon the occurrence of an event, and/or at defined time intervals, smart data management block 15 moves the archive files from the output buffers 25 to their respective storage device(s) 35. Exemplary events include but are not limited to messages indicating when storage device 35 is connected and

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ready for use, messages indicating when storage device 35 is inserted/removed, full, defective, etc., and messages indicating when storage device 35 is disconnected or unavailable, and messages from a storage device timer sent at time intervals controlled by the timer or at time intervals controlled by the user. The input buffer timer and the storage device timer may operate synchronously or non-synchronously.

Under certain conditions, smart data management block 15 may be unable, or may elect not to move the archive files. For example, if storage device 35 is unavailable then smart data management block 15 will not move the archive files to storage device 35. Among the conditions that may cause storage device 35 to be unavailable are i) storage device 35 is disconnected from computing device 5, ii) the connection between storage device 35 and computing device 5 is faulty or unacceptably slow, iii) storage device 35 is full, or iv) storage device 35 is malfunctioning. In addition, smart data management block 15 may also regulate movement of archive files according to time schedules set by the user, by monitoring connection bandwidth availability and moving files only during times of high bandwidth availability, or by monitoring other factors including messages that may received from storage location server requests for archive file transmittal.

A preferred operational mode for smart data management block 15 is illustrated in the flowcharts of FIGS. 2A and 2B. In step 100 of FIG. 2A, smart data manager 15 examines input buffer 20 to determine whether any archive files are stored therein. If no archive files are present, smart data manager 15 rests idle until the next event occurs. If archive files are detected, in step 105, smart data manager 15 updates database 25 to indicate the location of the archive files; that is, to indicate that the archive files are resident in input buffer 20. In step 110, smart data manager 15 examines database 30 to determine the proper destination for each archive file. In step 115, smart data manager 15 moves the archive files to output buffers 25. In step 120, smart data manager 15 updates database 30 to indicate that the archive files are now stored in the output buffer.

In FIG. 2B in step 125, the archive files are moved to one or more storage devices 30. If smart data manager 15 is unable to move the archive files to any of the storage devices 30, smart data manager 15 rests idle and does not move the archive files until it is notified that the storage device is available. Accordingly, the archive files remain in either input buffer 20 or output buffer 25 until smart data management block 15 is notified. In step 130 smart data manager 15 updates database 25 to indicate that the archive files are stored in one or more storage devices 30.

Use Specific to User Program Operations

The following examples are directed to embodiments of the invention specific to operations performed by a user program. The file capture, preservation and management processes of the invention are not limited to execution with the exemplary operation discussed below. The processes of the invention are preferably executed when a resident program causes a change or a change to be imminent in the operating file. Therefore, the following examples are intended to be exemplary only and non-limiting.

File Capture at File Open

As illustrated in FIG. 3, in step 205, the user or a program selects an “open” operation to open an operating file and an instruction to perform that “open” operation on the operating file is sent to the resident program. In step 210, file capture block 10 detects the instruction and captures the operating file. Optionally, prior to capturing the operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine

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whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 creates an archive file and stores the archive file in a storage location such as input buffer 20 or storage device 35 just before the resident program opens the operating file. Preferably, file capture block 10 stores the archive file in input buffer 20. In step 215 the resident program opens the operating file and in step 220 the user program displays the operating file as originally requested, e.g. Microsoft Word, and makes it available for the user to alter, e.g., edit a word processing document, amend or add to a database, etc. Step 210 is performed by momentarily delaying the execution of step 215 in such a manner as to have little or no perceptible impact on system performance from the user's point of view.

In step 225, the user program begins a process to save the altered operating file and an instruction to save the altered operating file is sent to the resident program. In step 230 the resident program saves the altered operating file pursuant to the instruction. In step 235, immediately after the altered operating file is saved by the resident program, file capture block 10 captures the altered operating file, preferably by creating and storing an archive file of the altered operating file in input buffer 20. In accordance with a preferred feature of the invention, file capture block 10 may save the archive file in such a way that previous revisions of the operating file are retained. That is, every time the operating file is changed, file capture block 10 saves an archive file and database 30 is updated with information about the archive file. Accordingly, over time, a plurality of archive files may be created from the original operating file. Each archive file represents a revision of the original operating file.

File Capture in the "RENAME" Operation

As illustrated in FIG. 4, step 305, in performing an operating file rename operation, the user or a program generates an instruction for the resident program to select a new name for an old operating file. In step 310, file capture block 10 detects the instruction and captures the old operating file. Optionally, prior to capturing the old operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 creates an archive file of the old operating file and stores the archive file in a storage location such as storage device 35 or, more preferably, input buffer 20 just before the resident program renames the old operating file. In step 315 the resident program renames the old operating file, thus creating a new operating file. Immediately after the old operating file is renamed, file capture block 10 captures the new operating file. Optionally, prior to capturing the new operating file, file capture block 10 may determine whether the new operating file has previously been archived, whether the user has selected the new operating file for protection, or other matching conditions exist. Like the archive file for the old operating file, the archive file for the new operating file is preferably stored in input buffer 20. In step 325 file capture block 10 and smart data management block 15 associate or link the new operating file with each of the versions of the old operating file to create a continuous operating file revision history.

File Capture in the "Delete" Operation

FIG. 5 illustrates the file capture process in the delete operation. In step 405, the user or a program identifies an operating file to delete and generates an instruction to the resident program. In step 410, file capture block 10 detects the instruction and captures the operating file just before it is

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deleted in step 415. Optionally, prior to capturing the operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 preferably captures the operating file. In step 420, the resident program deletes the operating file.

As shown by the examples given, a clear advantage of the invention is, regardless of the operation being performed, after each file capture step, file capture block 10 preferably updates database 30 to indicate the location of the corresponding archive file. Database 30 may keep track of multiple versions of an operating file, any of which may be accessed at the request of the user or other program.

Another advantage of the invention is that by capturing the operating file just before and/or just after an operation is performed thereon, the invention achieves near real-time operating file archiving while achieving minimal missed alterations to an operating file.

A further advantage of the invention in its preferred embodiment, is that by intelligently managing the migration of operating files from the input buffer 20 through the output buffer 25 to the storage device 35, the invention achieves protection of operating files even when the desired storage device is permanently or temporarily unavailable.

INDUSTRIAL APPLICABILITY

The present invention is suited for any application that requires or benefits from near real time file capture, that seeks improved file integrity and/or that seeks efficient management of file storage. For example, the present invention is particularly useful in backup systems, audit trail systems, computer security systems, systems for monitoring computer users and others.

Although the present invention has been described in terms of particular preferred embodiments, it is not limited to those embodiments. Alternative embodiments, examples, and modifications which would still be encompassed by the invention may be made by those skilled in the art, particularly in light of the foregoing teachings.

We claim:

1. A method for archiving files, comprising steps of (a) to (i) following:
 - (a) the step of detecting an instruction by a resident program in a computing device for performing an operation on an operating file;
 - (b) the step of creating an archive file from the operating file and storing the archive file in a temporary storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
 - (c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event;
 - (d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location;
 - (e) after storing the archive file in the temporary storage location, updating a database to indicate that the archive file is located in the temporary storage location;
 - (f) determining a final destination for the archive file;
 - (g) moving the archive file from the temporary storage location to an intermediate storage location;

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- (h) updating the database to indicate the archive file is located in the intermediate storage location; and
- (i) after moving the archive file to the second storage location, updating the database to indicate the archive file is located in the second storage location.

2. The method of claim 1, wherein the second storage location includes a personal attached storage device.

3. The method of claim 1, wherein the second storage location includes a network attached storage device.

4. The method of claim 1, wherein the second storage location includes a peer-to-peer storage device.

5. The method of claim 1, wherein the second storage location includes an internet storage area network.

6. An article of manufacture comprising a computer usable medium having computer readable program code for performing the method of claim 1.

7. An article of manufacture comprising a processor configured to perform the method of claim 1.

8. A method for archiving files, comprising the steps of:

- (a) the step of detecting an instruction by a resident program in a computing device for performing an operation on an operating file;
- (b) the step of creating an archive file from the operating file and storing the archive file in a temporary storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
- (c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event;
- (d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location;
- (e) after storing the archive file in the temporary storage location, updating a database to indicate that the archive file is located in the temporary storage location;
- (f) the step of moving the archive file from the temporary storage location to an output buffer;
- (g) the step of updating the database to indicate that the archive file is located in the output buffer;
- (h) the step of transmitting the archive file from the output buffer to the intermediate or the permanent storage location; and
- (i) the step of updating the database to indicate that the archive file is located in the intermediate or the permanent storage location.

9. The method of claim 8, wherein the second storage location includes a personal attached storage device.

10. The method of claim 8, wherein the second storage location includes a network attached storage device.

11. The method of claim 8, wherein the second storage location includes an Internet storage area network.

12. A method for archiving files, comprising steps of (a) to (d) following:

- (a) the step of detecting an instruction by a resident program in a computing device for performing an operation on an operating file;
- (b) the step of creating an archive file from the operating file and storing the archive file in a temporary storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
- (c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event; and

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- (d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location, wherein the second event includes a message indicating when the second storage location is available.

13. A method for archiving files, comprising steps of (a) to (d) following:

- (a) the step of detecting an instruction by a resident program in a computing device for performing an operation on an operating file;
- (b) the step of creating an archive file from the operating file and storing the archive file in a temporary storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
- (c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event; and
- (d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location, wherein the second event includes a message from a timer.

14. A method for archiving files, comprising steps of (a) to (d) following:

- (a) the step of detecting an instruction by a resident program in a computing device for performing an operation on an operating file;
- (b) the step of creating an archive file from the operating file and storing the archive file in a temporary storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
- (c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event; and
- (d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location, wherein the first event includes a message from a timer.

15. A method for archiving files, comprising steps of (a) to (d) following:

- (a) the step of detecting an instruction by a resident program in a computing device for performing an operation on an operating file;
- (b) the step of creating an archive file from the operating file and storing the archive file in a temporary storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction;
- (c) the step of identifying presence of the archive file in the temporary storage location responsive to the occurrence of a first event; and
- (d) the step of transmitting the archive file to a second storage location responsive to a second event, the second storage location being an intermediate or a permanent storage location, wherein the first event is different from the second event.

16. The method of claim 15, wherein the resident program is separate from an operating system.

17. The method of claim 16, where the resident program comprises a program having control over file operations on one or more operating files.

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18. The method of claim **15**, wherein the operation comprises one of read, write, save, rename, delete, copy, move, open, close, or create operations.

19. The method of claim **15**, wherein the operating file comprises one of a system file or a user file.

20. The method of claim **15**, wherein the archive file comprises at least some data of the operating file.

21. The method of claim **20**, wherein the archive file further comprises a reference to a location of a remainder of the data of the operating file.

22. The method of claim **15**, wherein the archive file comprises data of the operating file in one or a combination of a native format and an altered format.

23. The method of claim **15**, wherein the temporary storage location is located in a storage device internal to the computing device.

24. The method of claim **23**, wherein the temporary storage location comprises a buffer located in the storage device.

25. The method of claim **15**, wherein the temporary storage location is located in a storage device external to the computing device.

26. The method of claim **15**, wherein the first event comprises one of the following: a message from a process that

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created the archive file from the operating file, a message from the resident program, or a message from a timer.

27. The method of claim **15**, wherein the second event comprises one of the following: a message indicating when the intermediate or the permanent storage location is available, a message indicating when the intermediate or the permanent storage location is inserted, a message indicating high-bandwidth availability, a message from a server associated with the intermediate or the permanent storage location, or a message from a timer.

28. The method of claim **15**, wherein the intermediate or the permanent storage location is located in one of a personal attached storage device, a network attached storage device, a Internet storage area network, or a peer-to-peer storage device.

29. A non-transitory computer readable medium comprising program instruction for performing the method of claim **15**.

30. The method of claim **15**, wherein the intermediate or the permanent storage location is accessible by the computing device through the Internet.

31. The method of claim **15**, wherein the second storage location is the permanent storage location.

* * * * *

EXHIBIT C



US010585850B2

(12) **United States Patent**
Roach et al.

(10) **Patent No.:** US 10,585,850 B2
(45) **Date of Patent:** Mar. 10, 2020

(54) **AUTOMATIC REAL-TIME FILE
MANAGEMENT METHOD AND APPARATUS**

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(22) Filed: **Dec. 15, 2015**

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(51) **Int. Cl.**
G06F 17/30 (2006.01)
G06F 16/11 (2019.01)

(Continued)

(52) **U.S. Cl.**
CPC **G06F 16/113** (2019.01); **G06F 11/1461** (2013.01); **G06F 16/10** (2019.01); **G06F 16/86** (2019.01)

(58) **Field of Classification Search**
CPC G06F 11/1469

(Continued)

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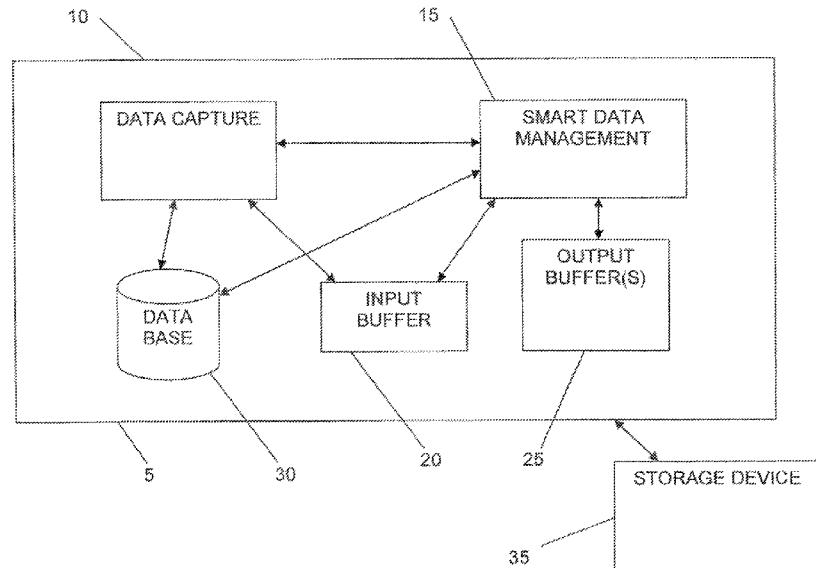
Primary Examiner — Baoquoc N To

(74) *Attorney, Agent, or Firm* — Aspire IP, LLC

(57) **ABSTRACT**

A method of restoring a file to a previous version of the file, where a current version of the file being available at a local storage location is disclosed. The method includes receiving a request to display a list of captured revisions for a file; displaying a list of captured revisions for said file; receiving a selection from said list indicating a revision of said file to restore; previewing selected revision of said file, wherein said selected revision of said file is received from an Internet storage area network; receiving another selection from said list indicating another revision of said file to restore; previewing selected another revision of said file, wherein said selected another revision of said file is received from a network attached storage location; and restoring selected another revision of said file following the previewing step.

21 Claims, 6 Drawing Sheets



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Related U.S. Application Data			
continuation of application No. 09/957,459, filed on Sep. 21, 2001, now Pat. No. 8,473,478.			
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(51) Int. Cl.			
G06F 16/10 (2019.01)			
G06F 16/84 (2019.01)			
G06F 11/14 (2006.01)			
(58) Field of Classification Search			
USPC 707/671, 655			
See application file for complete search history.			
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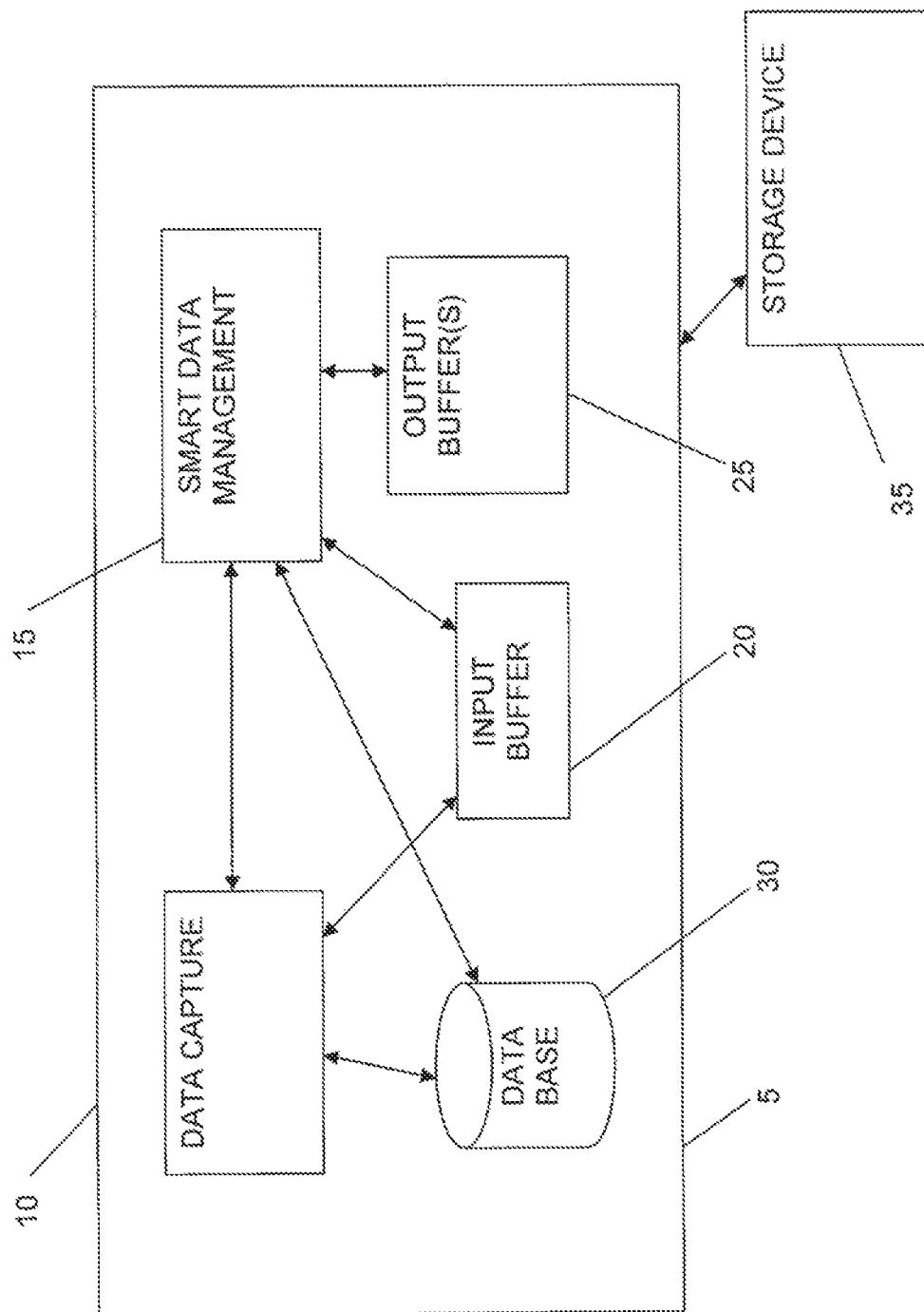


FIGURE 1

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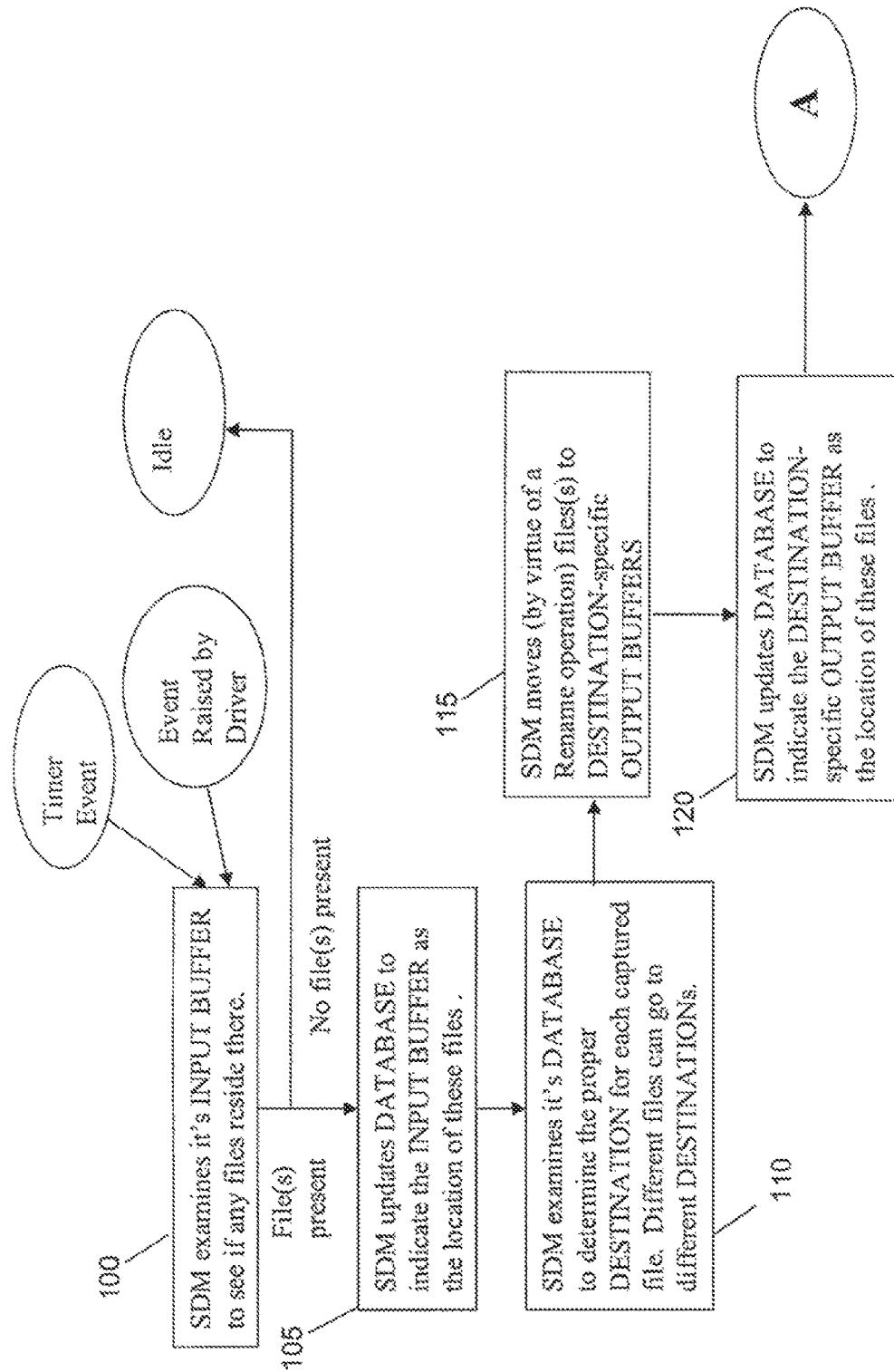


FIGURE 2A

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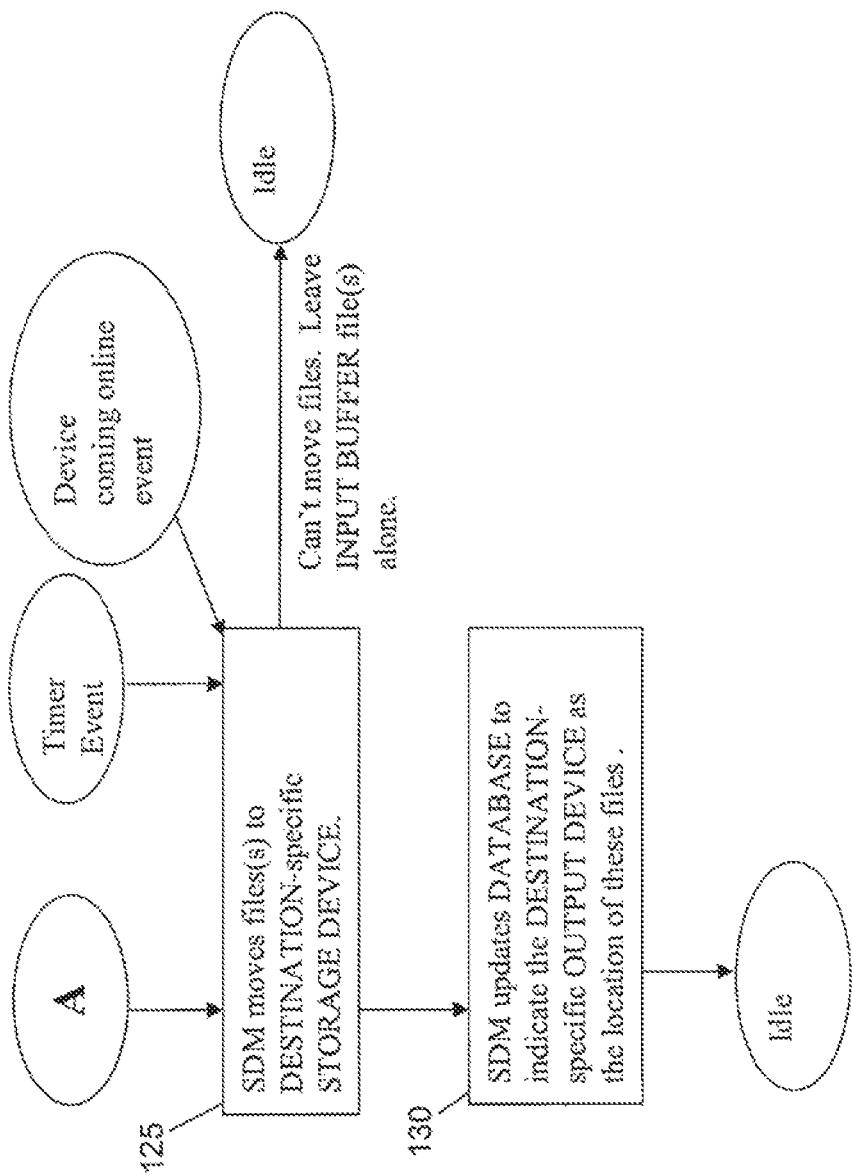


FIGURE 2B

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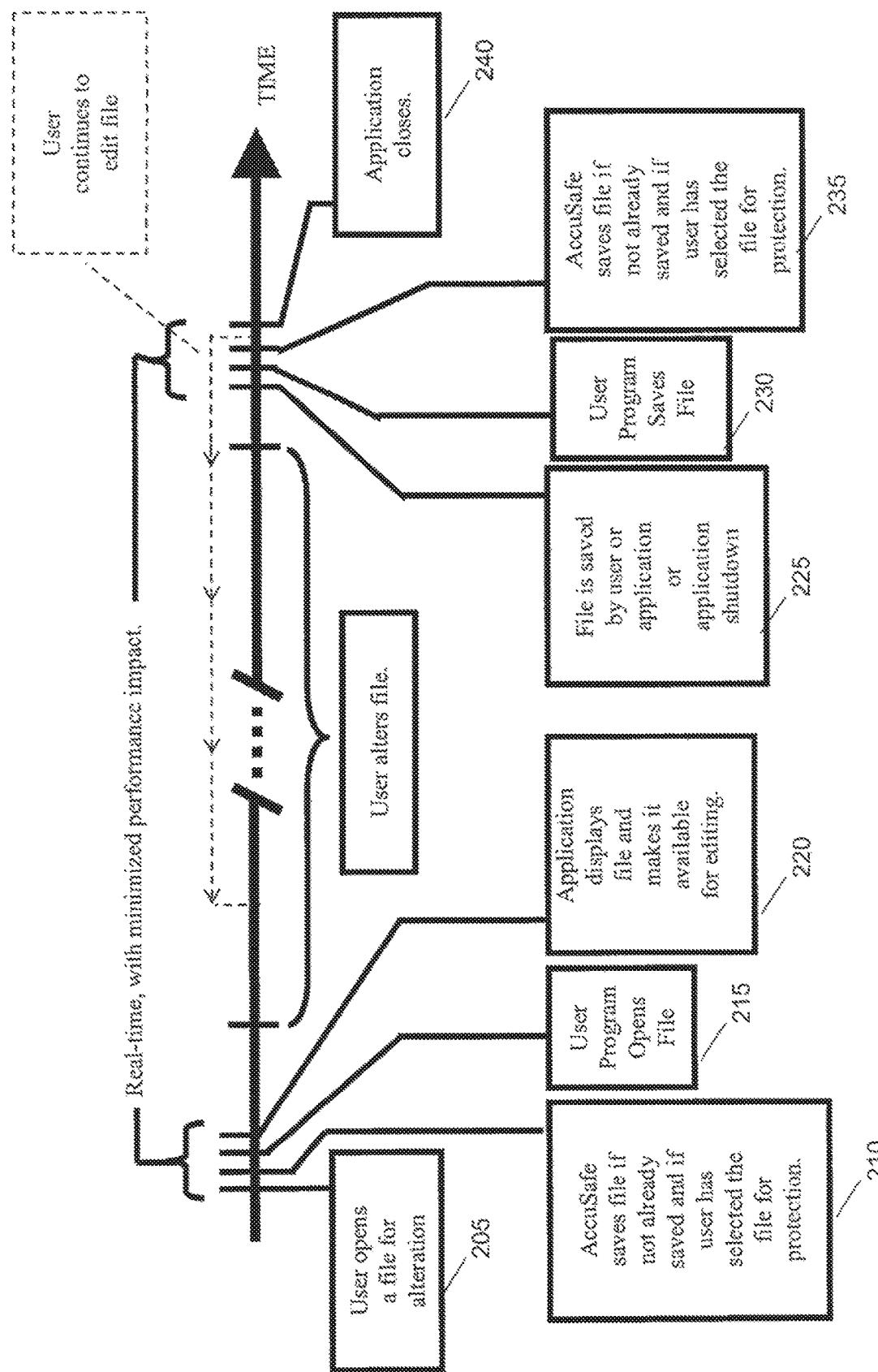


FIGURE 3

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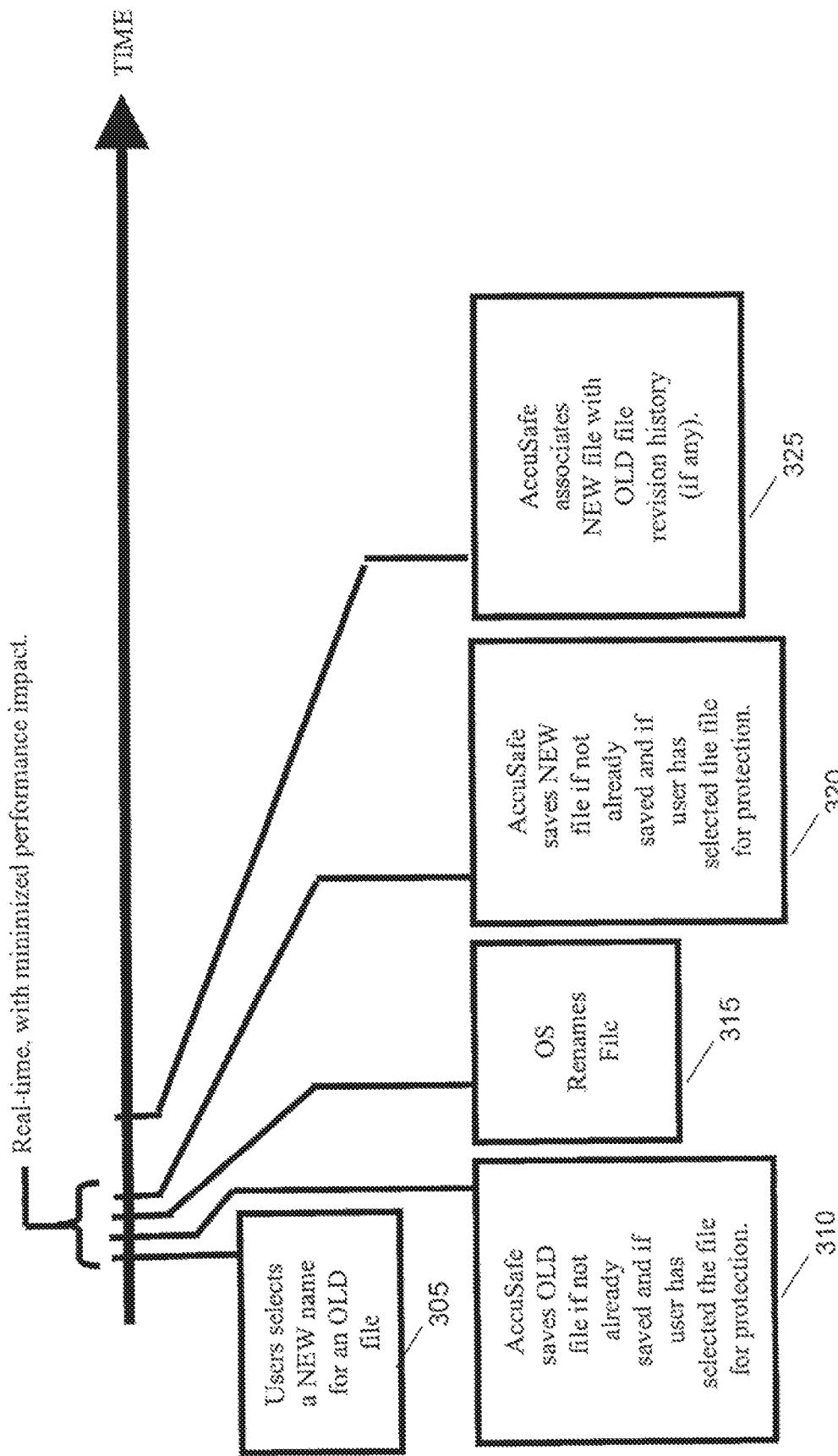


FIGURE 4

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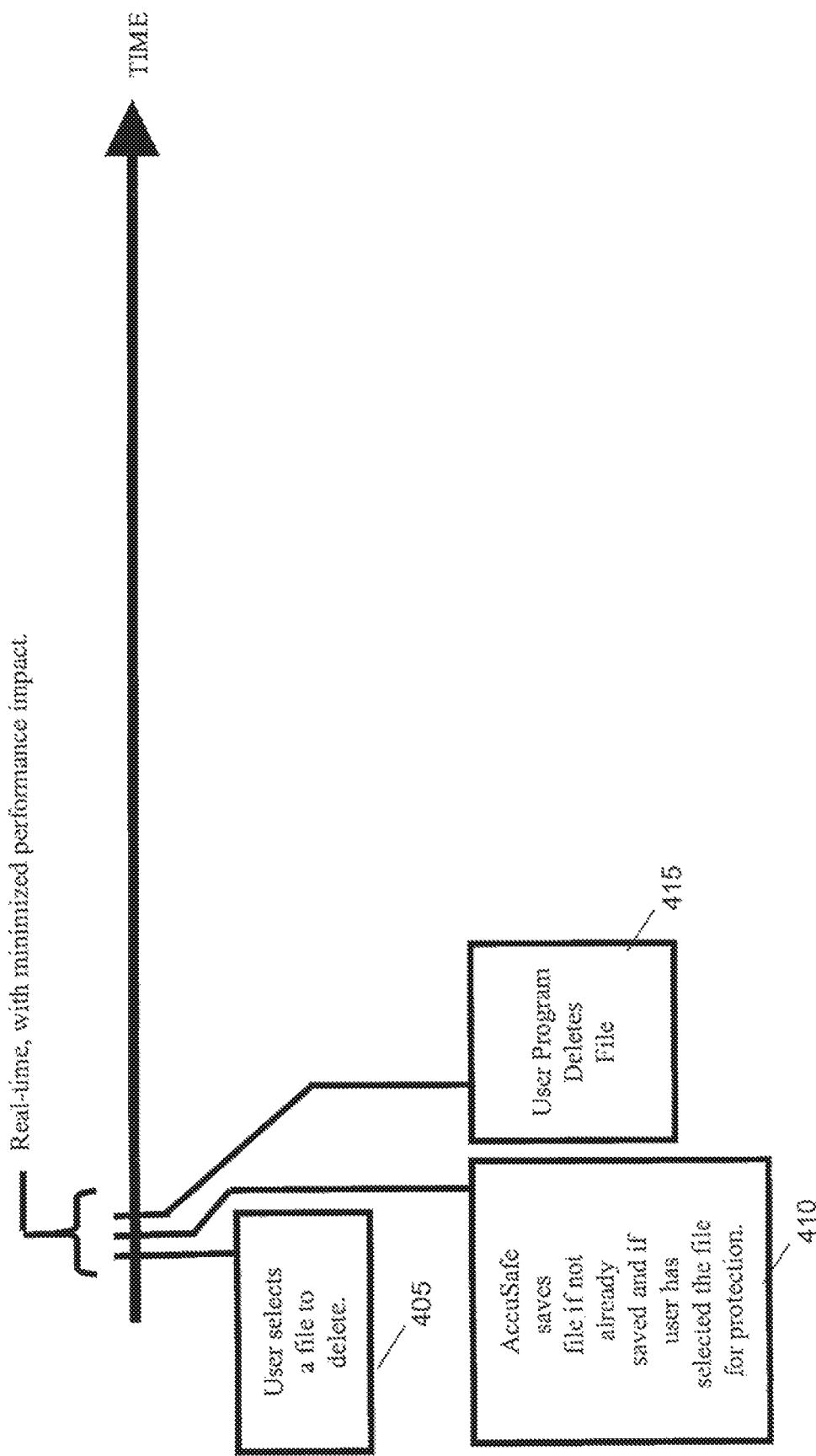


FIGURE 5

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AUTOMATIC REAL-TIME FILE MANAGEMENT METHOD AND APPARATUS

This application is a continuation of U.S. patent application Ser. No. 13/925,768 filed Jun. 24, 2013, which is a continuation of U.S. patent application Ser. No. 09/957,459 filed Sep. 21, 2001, now U.S. Pat. No. 8,473,478, which claims the benefit of U.S. Provisional Application No. 60/234,221 filed Sep. 21, 2000, each of which is herein incorporated by reference.

FIELD OF THE INVENTION

This invention relates to file preservation, file capture, file management and file integrity techniques for computing devices.

BACKGROUND OF THE INVENTION

One of the greatest challenges faced by information technology (IT) professionals and computer users today, particularly in the business environment is the protection and management of data. Data may be stored on user workstations, e.g., laptop computers, home or office desktop computers, network servers or other devices external to the workstations. Important data may even be stored on handheld computing devices such as PDAs, PALS and other like devices. Complicating the problem is the fact that the critically of data is increasing and the difficulty of managing it, protecting it from loss and keeping it available is increasing. This is due to a variety of factors, including: 1) the explosion in data volume, particularly that stored on desktop and laptop computers, 2) the increasing complexity of desktop and laptop computer software and hardware and increasing trends toward a paperless environment were absolute reliance (because paper copies are becoming less the norm) on data integrity is increasingly significant.

Many home computer users do not realize the vulnerability of their computer data. Many that do understand the very real potential for data loss, purchase backup systems whose operation and user interface is often confusing and/or time-consuming to use, dramatically decreasing their effectiveness or dependability. As a result, many computer users remain very much at risk of data loss resulting from hardware and/or software failures, fires, stolen equipment, etc. While these risks are significant, the most frequent cause of data loss is user error (accidental file deletes, file overwrites, errant programs, etc.), to which users remain very vulnerable even with most present day backup systems.

The financial impact of information loss is substantial. As reported by the Safeware Insurance Agency, in 1999 alone, insurance claims for damaged, lost and stolen computers (primarily notebook computers) totaled more than \$1.9 billion. This figure does not include the untold billions lost in intellectual capital and time. It is costly to recreate lost data and there are significant related costs such as lost productivity and lost opportunity. Consider, for example, the financial and health related impact of a doctor losing all patient contact information and medical histories due to a hard disk crash or some other type of computer failure. In addition, it is costly to keep desktop and laptop computers up and running in the wake of their increasing complexity.

A variety of products have been developed to address data preservation and integrity issues. These products may be loosely grouped into three categories, manual backup systems, schedule based backup systems and mirroring backup systems.

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The least efficient and probably one of the most frequently used backup systems is the manual backup. At times determined by the user, the user selects files to be backed up and either utilizes the built in backup procedure for the corresponding application or manually copies the selected files to a desired backup storage media.

The problems with this method of preserving data are self-evident. Backup procedures are often confusing and may differ from application to application. Accordingly, the 10 user must familiarize itself with the various methods for performing backups. In addition, users may forget to backup or elect not to on a given occasion due to time constraints or other reasons. Manual backups often do not allow the user to continue to use the system during the backup procedure. 15 Furthermore, data stored to the backup media is really only a "snapshot" of the data at the time that the backup is performed. Any changes made between manual backups would be lost if there was a failure on the computer's storage device.

20 Schedule based backup systems typically perform backups according to a schedule either set by the user or preset by the backup software. One of the major disadvantages of each type of schedule-based backup system is that as with manual backups, they miss work done between schedule points. This may cause the user to lose critical information as they work between schedule points. Another disadvantage of schedule-based backups systems is that they are frequently confusing and cumbersome for the user. Still another disadvantage of schedule-based backup systems is that they function poorly if at all when the backup storage device is unavailable, i.e., they cannot be written to due to a communications error or because the device has reached its capacity, is bandwidth limited, or is non-operational for some other reason.

25 30 35 Mirroring is a technique typically applied to disk based backup systems. Mirroring backup systems are the most comprehensive in that everything that happens to the source storage device immediately happens to the backup storage device. That is the backup drive becomes a mirror image of the source drive. Accordingly, if a failure occurs on the source disk, processing can be switched to the backup disk with little or no service interruption.

40 45 The strongest advantage of mirroring systems is also their strongest disadvantage. Because there is no operational discrimination, if a file is accidentally deleted from the source disk, it is deleted and cannot be preserved on the backup disk. Likewise, if a virus infects the source disks it is likely to infect the backup disk. Another disadvantage of mirroring systems is that separate backup disks are required for each source disk, doubling the disk requirement for the system. The backup disk must be at least as large as the source disk and the disks must be configured with identical volume mapping. Any extra space that may be present on the backup disk is unavailable.

50 55 60 All of these methods require that the user specify which files/directories to back up, but many users have no concept of files and directories in their thought process, much less are they able to correlate a particular application (e.g. Microsoft Excel) with the kinds and locations of files they generate. These systems simply require too much user knowledge, and too much user intervention. The backup user's risk increases dramatically the lower his computer knowledge may be.

In view of the foregoing, there is a need for a file capture, 65 preservation and management system that captures files just before and/or just after they have been changed to minimize loss of data between backup events. There is also a need for

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file capture and preservation system that captures files even when the destination storage medium for the files is unavailable. There is a further need for a system that allows users to recover easily and quickly from any type of information loss, including simple user errors, failed software installations or updates, hardware failures (attached storage devices), and lost or stolen laptop computers. Users should be able to recover on their own, without the intervention of the IT staff, and their backup systems should be as "behind the scenes" as possible, requiring little user attention and extremely small amounts of user computer knowledge.

SUMMARY OF THE INVENTION

It is an object of the invention to a file capture, preservation and management method and apparatus that captures files just before and/or just after the files are changed.

It is another object of the invention to provide a file capture, preservation and management method and apparatus that has an imperceptible impact on system performance from the user's point of view.

It is a further object of the invention to provide a file capture, preservation and management method and apparatus that captures and stores files even when there is no connection to the desired storage location.

Still another object of the invention is to provide a file capture, preservation and management method and apparatus that captures and stores files even when the desired storage location is unavailable.

In accordance with an aspect of the invention, a method for archiving files is provided. The method includes, in a computing device, detecting an instruction from a resident program to perform an operation on an operating file. Upon detection of the instruction, capturing the operating file temporally proximate to the operation being performed on the operating file.

In accordance with another aspect of the invention, a method for moving files from a first storage location to a second storage location is provided. The method includes, in a computing device, searching a first storage location for files responsive to the occurrence of a first event and moving the files from the first storage location to the second storage location responsive to a second event.

In accordance with still another aspect of the invention, a method for archiving files is provided. The method includes detecting an instruction from a resident program to perform an operation on an operating file. The method further includes creating an archive file from the operating file and storing the archive file in a first storage location temporally proximate to the operation being performed on the operating file and responsive to detecting the instruction. In keeping with the method, the first storage location is searched for an archive file responsive to the occurrence of a first event. The archive file is then moved from the first storage location to the second storage location responsive to a second event.

The accompanying figures show illustrative embodiments of the invention from which these and other of the objectives, novel features and advantages will be readily apparent.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a block diagram of a computing device in accordance with the present invention.

FIG. 2A is a flow chart depicting a process for moving files in accordance with the present invention.

FIG. 2B is a flow chart showing another process for moving files in accordance with the invention.

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FIG. 3 is a time line illustrating a sequence of events in an exemplary operation in accordance with the invention.

FIG. 4 is a time line illustrating a sequence of events in another exemplary operation in accordance with the invention.

FIG. 5 is a time line illustrating a sequence of events in still another exemplary operation in accordance with the invention.

DETAILED DESCRIPTION OF THE EMBODIMENT

Definitions

Operating System (OS)—A computer program that allocates system resources such as memory, disk space, and processor usage and makes it possible for the computer to boot up to a human user interface allowing the user to interact with the computer and control its operation.

Operating File—a system or user file.

Archive File—a file containing all of the data of an operating file in a native or altered format and/or a file containing at least some of the data of an operating file and including references to the location of the remainder of the data of the operating file.

Computing Device—a personal computer, a laptop or notebook computer, a server, a hand-held computing device, a PDA or a PAL. The term computing device is not specific to the kind of operating system being run on such computing device, and includes devices running Microsoft operating systems, Apple Macintosh operating systems, UNIX operating systems, Linux operating systems, and other operating systems.

Storage Location—any storage device, or a buffer, folder, directory or designated area on a storage device.

Personal Attached Storage Device—any internal or external storage device connected to a computing device.

Network Attached Storage Device—any storage device connected directly to a network to which a first computing device is also temporarily or permanently connected, or any storage device connected to a second computing device that is also temporarily or permanently connected to the network to which the first computing device is temporarily or permanently connected.

Internet storage area network—any storage area (device, collection of devices, etc.) that can be accessed by the computing device when the computing device is temporarily or permanently connected to the Internet.

Peer-to-Peer Storage Device—any storage area (device, collection of devices, etc.) that can be accessed by the computing device when it is sharing resources with other network or internet accessible computers.

Resident Program—an operating system (OS) or other program that has control over file operations such as "read", "write", "save", "rename", "delete", "copy", "move", "open", "close", etc.

User Program—an application software program or other computing program installed by the user or by the computer manufacturer for user creation of desired data, documents, or other information that is designed to enhance the functionality and/or enjoyment and/or usability of the computing device. The present invention is directed to an apparatus and/or method for file capture, presentation and management. The invention includes a file capture aspect and smart data management aspect. The invention may be realized as a method and/or an apparatus. More particularly, the invention may be realized as a set of program code instructions

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stored on a computer usable medium, a set of program code instructions embodied in a signal for transmitting computer information, and a processor and/or computing device configured as described herein.

FIG. 1 depicts a block diagram in accordance with the present invention comprising a computing device 5 including a file capture block 10 (or file captures), a smart data management block 15 (or smart data manager), an input buffer 20, output buffer(s) 25, and a database 30. A storage device 35 is also provided and may be either internal or external to computing device 5. The invention functions in conjunction with a resident program on computing device 5.

In accordance with an embodiment of the invention, file capture block 10 detects an instruction to perform an operation on an operating file initiated by the resident program of computing device 5. At a moment temporally proximate to when the resident program actually performs the operation, i.e., just before and/or just after the operation is performed on the operating file, or, more preferably, the instant before and/or the instant after the operating file is changed, file capture block 10 captures the operating file or portions thereof. Preferably, the operating file is captured within a few clock cycles of the detection of the instruction.

In keeping with a preferred aspect of the invention, file capture block 10 causes the location of the captured operating file to be recorded in database 30. The continued process of recording information about captured operating files, or portions thereof, in database 30 creates a record of each version of the operating file, which may be accessed by the user or by other programs.

File capture is preferably executed by creating an archive file from the operating file. The archive file is preferably stored in a temporary storage location, internal or external to the computer, such as input buffer 20. However, the archive file may be stored directly in storage device 35. In accordance with a preferred aspect of the invention, storage device 35 may be a personal attached storage device, a network attached storage device, an Internet storage area network, a peer-to-peer storage device, or other storage device.

In keeping with a preferred aspect of the invention, smart data management block 15 manages the migration of the archive file from the input buffer 20 through the output buffers 25 to storage device 35. This migration may take place either synchronously or asynchronously with the file capture procedures described herein. The time duration from a file arriving in input buffer 20 and when it arrives on archive storage device 35 is managed by the smart data management block 15. More particularly smart data management block 15 regularly examines input buffer 20 for the presence of archive files. Smart data management block 15 performs this examination upon the occurrence of an event, e.g., messages from the file capture block 10 and/or various messages from the resident program(s), messages from an input buffer timer sent at time intervals controlled by a timer or at time intervals selected by the user. Optionally, smart data management block 15 may then examine database 30 to determine a defined storage location for each of the archive files stored in input buffer 20. Each archive file stored in the input buffer 20 may be directed to the same storage location or to different storage locations and archive files may be directed to multiple storage locations for redundancy. Preferably, smart data management block 15 moves the archive files to one or more output buffers 25. More preferably each archive file is moved to output buffers 25 corresponding to the final storage location(s) for that archive file. Alternatively, all archive files may be moved to a single common

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output buffer 25 if desired. Upon the occurrence of an event, and/or at defined time intervals, smart data management block 15 moves the archive files from the output buffers 25 to their respective storage device(s) 35. Exemplary events include but are not limited to messages indicating when storage device 35 is connected and ready for use, messages indicating when storage device 35 is inserted/removed, full, defective, etc., and messages indicating when storage device 35 is disconnected or unavailable, and messages from a storage device timer sent at time intervals controlled by the timer or at time intervals controlled by the user. The input buffer timer and the storage device timer may operate synchronously or non-synchronously.

Under certain conditions, smart data management block 15 may be unable, or may elect not to move the archive files. For example, if storage device 35 is unavailable then smart data management block 15 will not move the archive files to storage device 35. Among the conditions that may cause storage device 35 to be unavailable are i) storage device 35 is disconnected from computing device 5, ii) the connection between storage device 35 and computing device 5 is faulty or unacceptably slow, iii) storage device 35 is full, or iv) storage device 35 is malfunctioning. In addition, smart data management block 15 may also regulate movement of archive files according to time schedules set by the user, by monitoring connection bandwidth availability and moving files only during times of high bandwidth availability, or by monitoring other factors including messages that may be received from storage location server requests for archive file transmittal.

A preferred operational mode for smart data management block 15 is illustrated in the flowcharts of FIGS. 2A and 2B. In step 100 of FIG. 2A, smart data manager 15 examines input buffer 20 to determine whether any archive files are stored therein. If no archive files are present, smart data manager 15 rests idle until the next event occurs, if archive files are detected, in step 105, smart data manager 15 updates database 25 to indicate the location of the archive files; that is, to indicate that the archive files are resident in Input buffer 20. In step 110, smart data manager 15 examines database 30 to determine the proper destination for each archive file. In step 115, smart data manager 15 moves the archive files to output buffers 25. In step 120, smart data manager 15 updates database 30 to indicate that the archive files are now stored in the output buffer.

In FIG. 2B in step 125, the archive files are moved to one or more storage devices 30. If smart data manager 15 is unable to move the archive files to any of the storage devices 30, smart data manager 15 rests idle and does not move the archive files until it is notified that the storage device is available. Accordingly, the archive files remain in either input buffer 20 or output buffer 25 until smart data management block 15 is notified. In step 130 smart data manager 15 updates database 25 to indicate that the archive files are stored in one or more storage devices 30.

Use Specific to User Program Operations

The following examples are directed to embodiments of the invention specific to operations performed by a user program. The file capture, preservation and management processes of the invention are not limited to execution with the exemplary operation discussed below. The processes of the invention are preferably executed when a resident program causes a change or a change to be imminent in the

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operating file. Therefore, the following examples are intended to be exemplary only and non-limiting.

File Capture at File Open

As illustrated in FIG. 3, in step 205, the user or a program selects an “open” operation to open an operating file and an instruction to perform that “open” operation on the operating file is sent to the resident program. In step 210, file capture block 10 detects the instruction and captures the operating file. Optionally, prior to capturing the operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 creates an archive file and stores the archive file in a storage location such as input buffer 20 or storage device 35 just before the resident program opens the operating file. Preferably, file capture block 10 stores the archive file in input buffer 20. In step 215 the resident program opens the operating file and in step 220 the user program displays the operating file as originally requested, e.g. Microsoft Word, and makes it available for the user to alter, e.g., edit a word processing document, amend or add to a database, etc. Step 210 is performed by momentarily delaying the execution of step 215 in such a manner as to have little or no perceptible impact on system performance from the users point of view.

In step 225, the user program begins a process to save the altered operating file and an instruction to save the altered operating file is sent to the resident program. In step 230 the resident program saves the altered operating file pursuant to the instruction. In step 235, immediately after the altered operating file is saved by the resident program, file capture block 10 captures the altered operating file, preferably by creating and storing an archive file of the altered operating file in input buffer 20. In accordance with a preferred feature of the invention, file capture block 10 may save the archive file in such a way that previous revisions of the operating file are retained. That is, every time the operating file is changed, file capture block 10 saves an archive file and database 30 is updated with information about the archive file. Accordingly, over time, a plurality of archive files may be created from the original operating file. Each archive file represents a revision of the original operating file.

File Capture in the “RENAME” Operation

As illustrated in FIG. 4, step 305, in performing an operating file rename operation, the user or a program generates an instruction for the resident program to select a new name for an old operating file. In step 310, file capture block 10 detects the instruction and captures the old operating file. Optionally, prior to capturing the old operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 creates an archive file of the old operating file and stores the archive file in a storage location such as storage device 35 or, more preferably, input buffer 20 just before the resident program renames the old operating file. In step 315 the resident program renames the old operating file, thus creating a new operating file. Immediately after the old operating file is renamed, file capture block 10 captures the new operating file. Optionally, prior to capturing the new

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operating file, file capture block 10 may determine whether the new operating file has previously been archived, whether the user has selected the new operating file for protection, or other matching conditions exist. Like the archive file for the old operating file, the archive file for the new operating file is preferably stored in input buffer 20. In step 325 file capture block 10 and smart data management block 15 associate or link the new operating file with each of the versions of the old operating file to create a continuous 10 operating file revision history.

File Capture in the “Delete” Operation

FIG. 5 illustrates the file capture process in the delete operation. In step 405, the user or a program identifies an operating file to delete and generates an instruction to the resident program. In step 410, file capture block 10 detects the instruction and captures the operating file Just before it is deleted in step 415. Optionally, prior to capturing the operating file, file capture block 10 may check database 30 to a) determine whether the operating file has previously been archived, b) determine whether the user has selected the operating file for protection, or c) determine a match to other defined conditions. If the go-ahead conditions exist, then file capture block 10 preferably captures the operating file. In step 420, the resident program deletes the operating file.

As shown by the examples given, a clear advantage of the invention is, regardless of the operation being performed, 30 after each file capture step, file capture block 10 preferably updates database 30 to indicate the location of the corresponding archive file. Database 30 may keep track of multiple versions of an operating file, any of which may be accessed at the request of the user or other program.

Another advantage of the invention is that by capturing the operating file just before and/or just after an operation is performed thereon, the invention achieves near real-time operating file archiving while achieving minimal missed alterations to an operating file.

40 A further advantage of the invention in its preferred embodiment, is that by intelligently managing the migration of operating files from the input buffer 20 through the output buffer 25 to the storage device 35, the invention achieves protection of operating files even when the desired storage 45 device is permanently or temporarily unavailable.

INDUSTRIAL APPLICABILITY

The present invention is suited for any application that 50 requires or benefits from near real time file capture, that seeks improved file integrity and/or that seeks efficient management of file storage. For example, the present invention is particularly useful in backup systems, audit trail systems, computer security systems, systems for monitoring computer users and others.

Although the present invention has been described in terms of particular preferred embodiments, it is not limited to those embodiments. Alternative embodiments, examples, and modifications which would still be encompassed by the invention may be made by those skilled in the art, particularly in light of the foregoing teachings.

We claim:

1. A method of restoring a file to a previous version of the file, a current version of the file being available at a local 60 storage location, comprising the steps of:

(A) presenting information for a collection of one or more 65 previous versions of the file, the information for the

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collection including information indicative of at least one or more of previous versions of the file, wherein a restorable representation of each version, V, of the previous versions, is retrievable from a remote storage location, the restorable representation having at least information required for recovering the version V by a computational machine with the current version being accessible, the remote storage location being accessible through a network;

(B) responsive to a selection to preview a selected previous version of the file based on the presented information for the collection of (A), presenting a presentable representation of the selected previous version, the selected previous version being one of the previous versions of the file in the presented information for the collection, the presentable representation having at least information required for presenting at least a portion of the selected previous version by the computation machine with the current version being accessible; and

(C) responsive to a selection to restore the selected previous version, retrieving the restorable representation of the selected previous version from the remote storage location and storing the selected previous version by the computational machine as the current version on the local storage location, the selected previous version available from the restorable representation of the selected previous version.

2. The method of claim 1, wherein, for the presenting of (B), the presentable representation is presented using an application that created the file or the selected previous version.

3. The method of claim 2, wherein the application is in a read-only mode.

4. The method of claim 1, wherein the information includes at least two previous versions of the file.

5. The method of claim 1, wherein the information for the collection includes information indicative of at least one or more of a timestamp, an original file location, and a comment of the previous versions or the file.

6. The method of claim 1, further comprising the steps of: (B2) after the presenting of (B) and responsive to a selection to not restoring the previous version and responsive to a second selection of a second previous version of the previous versions, version presenting a second presentable representation of the selected second previous version, the second presentable representation having at least information required for presenting at least a portion of the selected previous version; and

(C2) responsive to a selection to restore the second selected previous version, retrieving the restorable representation of the second selected previous version from the remote storage location and storing the second selected previous version as the current version on the local storage location, the second selected previous version available from the restorable representation of the second selected previous version.

7. The method of claim 1, wherein the restorable representation of the selected previous version comprises one or more of a compressed and encrypted version of the selected previous version.

8. The method of claim 1, wherein the restorable representation of the selected previous version comprises an incremental change to the file.

9. The method of claim 1, wherein the method has a substantially imperceptible impact on system performance

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from a user's point of view by delaying one or more operations to prevent a perceptible impact on system performance from a user's point of view.

10. A method of restoring a file to a previous version of the file, a current version of the file being available at a local storage location, comprising the steps of:

(A) presenting information for a collection of one or more previous versions of the file, the information for the collection including information indicative of at least one or more of previous versions of the file, wherein a restorable representation of each version, V, of the previous versions, is retrievable from a remote storage location, the restorable representation having at least information required for recovering the version V, the remote storage location being accessible through a network;

(B) responsive to a selection to preview a selected previous version of the file based on the presented information for the collection of (A), presenting a presentable representation of the selected previous version, the selected previous version being one of the previous versions of the file in the presented information for the collection, the presentable representation having at least information required for presenting at least a portion of the selected previous version;

(C) responsive to a selection to restore the selected previous version, retrieving the restorable representation of the selected previous version from the remote storage location and storing the selected previous version as the current version on the local storage location, the selected previous version available from the restorable representation of the selected previous version.

11. The method of claim 10, wherein, for the presenting of (B), the presentable representation is presented using an application that created the file or the selected previous version.

12. The method of claim 10, wherein the information includes at least two previous versions of the file.

13. The method of claim 10, wherein the information for the collection includes information indicative of at least one or more of a timestamp, an original file location, and a comment of the previous versions or the file.

14. The method of claim 10, further comprising the steps of:

(B2) after the presenting of (B) and responsive to a selection to not restoring the previous version and responsive to a second selection of a second previous version of the previous versions, version presenting a second presentable representation of the selected second previous version, the second presentable representation having at least information required for presenting at least a portion of the selected previous version; and

(C2) responsive to a selection to restore the second selected previous version, retrieving the restorable representation of the second selected previous version from the remote storage location and storing the second selected previous version as the current version on the local storage location, the second selected previous version available from the restorable representation of the second selected previous version.

15. The method of claim 10, wherein the restorable representation of the selected previous version comprises one or more of a compressed and encrypted version of the selected previous version.

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16. The method of claim **10**, wherein the restorable representation of the selected previous version comprises an incremental change to the file.

17. The method of claim **10**, wherein the method has a substantially imperceptible impact on system performance from a user's point of view by delaying one or more operations to prevent a perceptible impact on system performance from a user's point of view.

18. A method of restoring a file to a previous version of the file, a current version of the file being available at a local storage location, comprising the steps of:

(A) iteratively transmitting a representation of at least a portion of a current version of a file to a remote storage location for archiving the current version responsive to a determination of an availability of the remote storage location for accepting a transmission of the representation, the current version being accessible at a computational machine, the remote storage location being accessible through a network;

(B) presenting information for a collection of one or more previous versions of the file, the information for the collection including information indicative of at least one or more of previous versions of the file, wherein a restorable representation of each version, V, of the previous versions, is retrievable from the remote storage location, the restorable representation having at least information required for recovering the version V by the computational machine, the remote storage location being accessible through a network;

(C) responsive to a selection to preview a selected previous version of the file based on the presented information for the collection of (B), presenting a presentable representation of the selected previous version, the selected previous version being one of the previous versions of the file in the presented information for the collection, the presentable representation having at least information required for presenting at least a portion of the selected previous version by the computation machine with the current version being accessible; and

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(D) responsive to a selection to restore the selected previous version, retrieving the restorable representation of the selected previous version from the remote storage location and storing the selected previous version by the computational machine as the current version on the local storage location, the selected previous version available from the restorable representation of the selected previous version.

19. A method of restoring a file to a previous version of the file, a current version of the file being available at a local storage location, comprising the steps of:

- (a) receiving a request to display a list of captured revisions for a file;
- (b) displaying a list of captured revisions for said file;
- (c) receiving a selection from said list indicating a revision of said file to restore;
- (d) previewing selected revision of said file, wherein said selected revision of said file is received from an Internet storage area network;
- (e) receiving another selection from said list indicating another revision of said file to restore;
- (f) previewing selected another revision of said file, wherein said selected another revision of said file is received from a network attached storage location; and
- (g) restoring selected another revision of said file following said previewing step in (f), optionally, decrypting said selected revision of said file prior to step (d) and decrypting said selected another revision of said file prior to step (f).

20. The method of claim **19**, wherein said method comprises decompressing said selected revision of said file prior to (d) and decompressing said selected another revision of said file prior to (f).

21. The method of claim **19**, further comprising the step of decompressing said selected revision of said file prior to step (d) and decompressing said selected another revision of said file prior to step (f).

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